# Environmental Assesssment
# for
# Lead Pollution Clean-Up in Qalyoubia

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## ACRONYMS

| | |
|---|---|
| ASU-RL | Ain Shams University- Reference Laboratory |
| AQMC | Air Quality Monitoring Component |
| BHHRA | Baseline Human Health Risk Assessment |
| CAA | Competent Administrative Authority |
| CAIP | Cairo Air Improvement Project |
| Chemonics | Chemonics International |
| EA | Environmental Assessment |
| EIA | Environmental Impact Assessment |
| EEAA | Egyptian Environmental Affairs Agency |
| EMP | Environmental Management Plan |
| EMRA | Egyptian Mineral Resources Authority |
| ER | Executive Regulations |
| ERP | Emergency Response Plan |
| GOE | Government of Egypt |
| GOQ | Governorate of Qalyoubia |
| HEPA | High Efficiency Particulate Air |
| HI | Hazard Index |
| IEUBK | Integrated Exposure Update BioKinetic |
| LEAP | Lead Exposure Abatement Plan |
| LIFE | Livelihood and Income From the Environment program |
| LSAP | Lead Smelter Action Plan |
| MSE | Millennium Science & Engineering, Inc. |
| PbB | Blood Lead Concentration |
| PM | Particulate Matter |
| RAGS | Risk Assessment Guidance for Superfund: Volume 1 - Human Health Evaluation Manual, (Part A), Interim Final |
| RBRG | Risk-Based Remediation Goal |
| SAP | Sampling and Analysis Plan |
| SCEM | Site Conceptual Exposure Model |
| SFI | Inhalation Oral Slope Factor for carcinogenic chemicals |
| SFo | Oral Slope Factor for carcinogenic chemicals |
| URF | Unit Risk Factor |
| USAID | United States Agency for International Development |
| USEPA | United States Environmental Protection Agency |

## Symbols for Metals

| | |
|---|---|
| As | Arsenic |
| Cd | Cadmium |
| Cr | Chromium |
| Cu | Copper |
| Pb | Lead |
| Sb | Antimony |
| Se | Selenium |
| Zn | Zinc |

## Units of Measurement

| | |
|---|---|
| m | meter |
| $m^2$ | square meter |
| mg/kg | milligram per kilogram (parts per million) |
| $\mu g/ft^2$ | microgram per square foot |
| µg/g | microgram per gram (parts per million) |
| mg/L | milligram per liter |
| µm | micrometer (micron) |

## EXECUTIVE SUMMARY AND RECOMMENDATION

Millennium Science & Engineering, Inc. in association with Chemonics International (MSE/Chemonics) has prepared this Environmental Assessment (EA) for the United States Agency for International Development (USAID). The purpose of the EA is to address the impacts associated with the remediation of five secondary lead smelters and the El Shahid Ahmed Shaalan School in Shoubra El Kheima, Qalyoubia. The EA is being funded through the USAID's Livelihood and Income from the Environment Program, Lead Pollution Clean-Up in Qalyoubia Project (LIFE-Lead).

### Project Description

Lead contamination from secondary lead smelters in Shoubra El Kheima poses serious health threats to the people living and working near the former smelters. To address this problem, the USAID and the Government of Egypt (GOE) designed a lead clean-up component under LIFE. The goal of the project is to remediate lead pollution in five secondary lead smelter sites (i.e., Awadallah Nos. 1, 2, and 3, and the El Mahy and Seoudi Smelters) and the El Shahid Ahmed Shaalan School located near the lead smelters in Shoubra El Kheima. The remediation of the lead smelters will result in reduced risks to human health and the environment by lowering lead contamination to acceptable levels. In addition to site remediation, the project includes activities in community involvement and public participation, communication, capacity building, and policy/legal support.

Several governmental and non-governmental entities are directly or indirectly involved in the implementation of the project activities. Governmental entities include the Egyptian Environmental Affairs Agency (EEAA), the Governarate of Qalyoubia (GOQ), and the Ministries of Health, Education, and Industry. Non-governmental organizations include the Community Development Associations, the Integrated Care Society, the National Council for Women, the private sector, and the media.

The proposed project actions include the following elements:

- Remediation of 5 secondary lead smelter sites.
- Remediation of the El-Shahid Ahmed Shalaan School.

The remediation design calls for remediation of soil, waste piles, buildings, and structures to levels equal to or less than the proposed baseline human health risk goals set by the project in cooperation with the EEAA. After remediation , the future use of the smelters sites will be safe for workers and occupants. In addition, lead pollution hazards will be significantly reduced for the people of Shoubra El Kheima.

Following the conduct of site characterization studies at the five secondary lead smelters and the school , a short list of remediation alternatives was developed for each site. The proposed action and the No-Action Alternative are fully considered in this EA for each of the sites proposed for remediation.

Tripartite legal agreements were drafted by the project and signed by the school management, smelters owners, EEAA and the GOQ representatives to stipulate the mutual commitments of all parties. By signing these agreements the school management, smelters owners, guarantee accessibility to their facilities, declare the planned future use of their lands, and commit themselves to cooperate with all project's activities. In return, EEAA and GOQ would suspend all fines and accusations against these smelters until the conclusion of the remediation processes.

## Environmental Setting

The population in Hai Shark (East District) of Shoubra El Kheima increased from 454,000 in 1996 to 536,900 in 2001 with an annual population growth rate of 3.7 percent. This annual growth rate is higher than in other parts of Shoubra El Kheima, the GOQ, or in Egypt as a whole.

The population of concern is 182,096 residents in the study area, which is defined as a circle with a radius of one kilometer around the Awadallah Smelter No. 1. The population inhabiting this area is distributed among four administrative subdistricts: Mostorod, Bahteem, Masaken El Amiria, and El Zawya El Hamra. Approximately 20 percent of the population in Mostorod, Bahteem, and El Zawya El Hamra and 80 percent of the population in Masaken El Amiria are located within the study area. Table 2.1 presents population estimates for the study area, including estimates for the children seven years old and under and the females of reproductive age sub-populations that are at highest risk from lead contamination.

The five secondary lead smelters and school sites to be remediated are located in mixed industrial, residential, and agricultural land uses. The smelters and the school are located within the Nile River flood plain. The topography of the area is almost flat with an average elevation of 17 meters above mean sea level. The climate of the site is considered arid with annual rainfall of approximately 25 millimeters per year.

The general area of the smelters and the school is underlain by two hydrogeologic units, an upper silt and clay layer beneath which is an alluvial aquifer. The top of the water table is from five to six meters below the ground surface. The groundwater flow direction trends to the NNW consistent with the flow direction of the Ismailia Canal. Seasonal variations in flow direction are negligible as the canal is maintained at near the same level throughout the year. Generally, the aquifer in Shoubra El Kheima is used by local industries and is not a drinking source. Potable water is provided to the residents by the GOQ.

Four of the smelters (Awadallah No. 1, Awadallah No. 2, Seoudi, and El Mahy) and the school are located within 100 meters of the Ismailia Canal. The fifth smelter (Awadallah No. 3) is located 500 meters north of the canal. The Ismailia Canal is a source of recharge to the aquifer as well as a source of drinking water in other areas of the GOQ.

Air pollution in Shoubra El Kheima is mainly a result of industrial activities and vehicle traffic. Particulate matter (PM) and lead monitoring results were obtained from 36 sites in the Greater Cairo metropolitan area from October 1998 to July 1999. The results indicated that the highest PM10, PM2.5, and lead concentrations were observed in the industrial areas of Shoubra El Kheima.

The project site is located within the urban landscape matrix of Greater Cairo, parallel to the Ismailia Canal. The project area, which can be considered as a man made environment, appears to have little ecological significance and low biodiversity due to the immense alteration of the natural ecology. The most important ecological feature is Ismailia Canal that runs as a corridor to the south of the project site.

## Impact Assessment

The GOE is currently developing an industrial relocation plan for industries located in residential areas that have a significant negative impact on public health and the environment. The project is consistent with those planning efforts as the secondary lead smelters were some of the initial industries identified in the GOE industrial relocation plan. Factors identified during the scoping activities were assessed for potential impacts associated with the remediation actions of the project

The remediation activities were found to have positive impacts relative to the following:

- Employment benefits for the local community during the period of site remediation.
- Initiation of new hazardous waste site remediation businesses.
- Improvement of the environmental quality (air, soil, and water quality) in the area, due to elimination of lead health exposure pathways.
- Improvement in the quality of life.
- Appreciation the value of land in Shoubra El Kheima.

Minimal or negligible negative impacts are expected in the following areas:

- Air Quality (Fugitive dusts and gaseous emissions).
- Noise.
- Traffic.
- Soil quality along transportation routes to disposal sites could be negatively impacted if transported waste is not properly covered.
- Potential risks to workers health and safety associated with remediation activities.

Surface, groundwater, and sediments samples taken within the vicinity of the smelter sites tested for lead showed lead concentrations below the legal limits with the exception of one sample collected from a shallow monitoring well along the Ismailia Canal. Careful control of the remediation activities and periodic monitoring will ensure no alteration to such status.

No major negative impacts on natural, physical, or economic resources were identified during the development of this EA. No cross-sectoral or cumulative impacts have been identified.

## Comparison of Alternatives

The No-action Alternative represents further increase in lead pollution hazards for the population of Shoubra El Kheima and the environment. Exposure to lead contamination from secondary smelting may cause a wide variety of adverse health effects, ranging from reduction in the intelligence quotient of children to kidney cancer. Lead emissions are of particular concern for women of childbearing age and children under seven years of age. Children and young adults in areas that have been contaminated by smelter emissions can be exposed to lead through inhaling or ingesting dust and soil. Fugitive dust from the smelter and the surrounding area can be wind blown and deposited on uncovered food and water and subsequently ingested.

The project will improve air quality in Shoubra El Kheima through the removal of contaminated lead dust. Improvement of soil, surface water, and groundwater quality within the area will result from the remediation activities. In the absence of significant negative impacts, the proposed remediation actions will offer substantial benefits relative to the No-Action Alternative.

## Management, Mitigation, and Monitoring

Mitigation measures will be implemented to control potential negative impacts to the environment due to the remediation process. Mitigation measures will include the following:

- Dust generation control.
- Noise abatement.
- Onsite storage and handling of hazardous materials.
- Mitigate potential impacts on traffic through traffic control planning.
- Emissions control.
- Health and safety protection will be enforced on workers.

Monitoring of the following will be undertaken during the remediation activities:

- Air quality (ambient and indoors).
- Noise.
- Soil.
- Surface water and groundwater quality.

## Recommendation

The remediation of the five secondary lead smelters and the El Shahid Ahmed Shaalan School will have a positive impact on human health and the environment in Shoubra El Kheima. The remediation process will be removing major sources of lead contamination in the area. The proposed remediation actions should be implemented with appropriate monitoring and mitigation measures.

To facilitate the remediation actions, Tripartite legal agreements were drafted by the project and signed by the school management, smelters owners, EEAA and the GOQ representatives to stipulate the mutual commitments of all parties. By signing these agreements the school management, smelters owners, guarantee accessibility to their facilities, declare the planned future use of their lands, and commit themselves to cooperate with all project's activities. In return, EEAA and GOQ would suspend all fines and accusations against these smelters until the conclusion of the remediation processes.

# 1. PROJECT DESCRIPTION

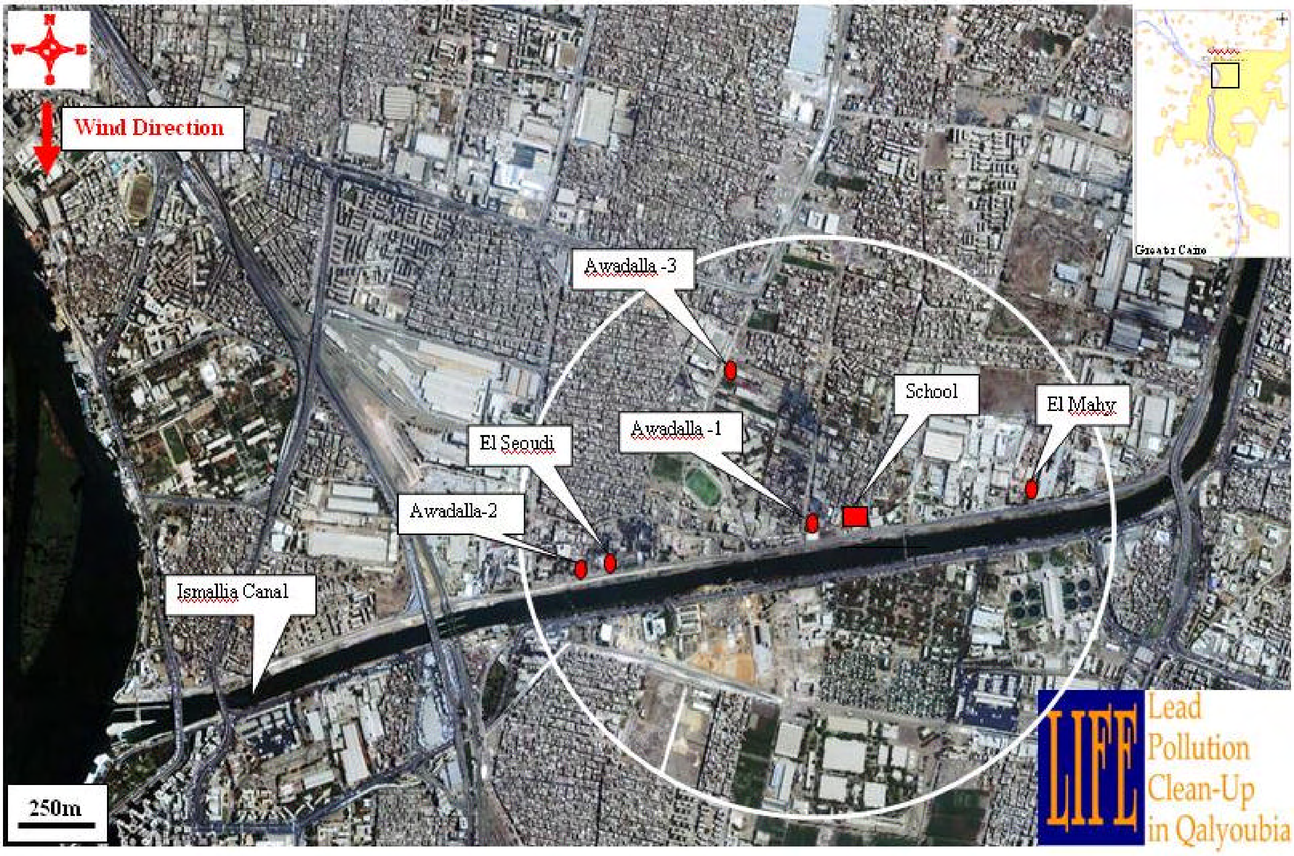
Lead contamination from secondary lead smelters in Shoubra El Kheima, Qalyoubia poses serious health impacts for the residents living near the smelters. To address this problem, the United States Agency for International Development (USAID) and the Government of Egypt (GOE) designed a lead clean-up component under the Livelihood and Income from the Environment Program (LIFE). The clean-up project is called LIFE Lead Pollution Clean-up in Qalyoubia (LIFE-Lead). The Life-Lead project is being implemented by Millennium Science & Engineering, Inc. in association with Chemonics International (MSE/Chemonics).

## 1.1 Project Setting

### 1.1.1 Location

All of the sites that will be included in the Life-Lead remediation project are located near the southern border of the Qalyoubia Governorate in the Hai Shark (East District) of the City of Shoubra El Kheima (Figure 1.1).

**Figure 1.1 Locations of the Contaminated Sites under Investigation**[MSOffice1]




The remediation activities will be conducted at the following five secondary lead smelter sites and one school:

- Awadallah Smelter No. 1 is located on El Magary Street near Ismailia Canal Road.

- Awadallah Smelter No. 2 is located in the Ard El Khors Wa El Aguam area on El Rashah Street near Decorama Street.

- Awadallah Smelter No. 3 is located on Rashah Shebeen Street near 15th of May Street.

- Seoudi Smelter is located on Decorama Street near El Rashah Street.

- El Mahy Smelter is located on El Rashah Street near Ismailia Canal Road.

- El Shahid Ahmed Shaalan School is located on Ismailia Canal Road between El Shoubra Canal Street and El Magary Street.

### 1.1.2 Purpose

The overall goal of the project is to empower local residents in the polluted communities to improve their living conditions. The focus of the project is remediation at five secondary lead smelter sites and a nearby school. In addition to site remediation, the project includes activities in community involvement and public participation, communications, capacity building, and policy/legal support. The scope of the Life-Lead project does not include remediation outside the boundaries of the five smelters and the school.

### 1.1.3 Stage in Planning Process

Several USAID funded analyses have assisted with the development of an understanding of lead pollution in Egypt and the potential for reducing it. The threat was first estimated through a comparative risk analysis effort in 1994. This study ranked lead contamination as one of the Egypt's most serious environmental problems. The Lead Exposure Abatement Plan (LEAP) further documented sources of human exposure to lead in Egypt and potential mitigation measures. A separate Lead Smelter Action Plan (LSAP) defined activities to reduce the threat of secondary smelters.

Beginning in 1997, the Cairo Air Improvement Program (CAIP) implemented the LSAP, assisting with the relocation and upgrading of smelters, supporting policy dialogue to reduce demand for lead-based products, and initiating investigations of contamination at smelter sites following relocation and closure. The CAIP focused efforts in the area of Shoubra El Kheima, which has five lead smelters. Activities supporting the air objective of the Egyptian Environmental Policy Program (EEPP) further addressed contaminated smelter sites as well as prohibited smelting activities and forced proper smelter site cleanups in Shoubra El Kheima. Findings demonstrated that areas surrounding the smelter properties including nearby streets, homes, and other buildings are heavily contaminated with lead and other metals.

Given the substantial health threat posed by lead contamination in Qalyoubia and opportunities to involve the community in mitigating the problem, USAID designed Life-Lead. This program includes the following:

- Site characterizations,
- Develops remediation strategies,
- Provides significant capacity building to local contractors,
- Prepares remediation designs and tender packages, and

- Implements remediation activities.

### 1.1.4 Summary of USAID and Egypt's Environmental Procedures

#### USAID Procedures

All projects funded by USAID are subject to United States governmental regulations for environmental impact assessment.[1] Under these regulations, actions that will have a significant impact on the environment in the country of implementation require the preparation of an Environmental Assessment (EA).

An Initial Environmental Examination is conducted as the first review of the reasonably foreseeable effect of a proposed action and provides a brief statement of the factual basis for deciding whether an EA will be required. USAID has determined that the clean-up activities to be conducted by Life-Lead will have significant impacts on the environment of Egypt, thus the project is subject to an EA.

The EA is prepared to provide the USAID and the host country decision makers with a full discussion of significant environmental effects of a proposed action. For an EA process, the originator of the action commences the process of identifying the significant issues related to the proposed action and determining the scope of the issue to be addressed.

Persons with experience relevant to the environmental aspects of the proposed action participated in this scoping process. However, this process was not limited to these experts. A public scoping meeting was conducted on February 2, 2005 to introduce the project's stakeholders to project components as well as identify their concerns towards project activities. The scoping process resulted in a written document illustrating the scope and significance of issues to be analyzed in the EA, including direct and indirect effects of the project on the environment.

This was followed by the preparation of the EA. The EA will be reviewed as an integral part of the project. It will be reviewed and cleared by the Bureau Environment Officer. The Agency's Environmental Coordinator who will monitor the environmental assessment process may also review this document.

#### Egyptian Procedures

According to the Egyptian Law of the Environment, Law 4/1994, and its Executive Regulations (ERs), an Environmental Impact Assessment (EIA) must be submitted for new projects and/or extension of existing facilities licensing. Therefore, environmental requirements are integrated into the existing licensing system.

According to the law, the EIA must be submitted to the Competent Administrative Authority (CAA), under which project jurisdiction falls. The CAA should assess the environmental impacts of the project and submit the EIA to the Egyptian Environmental Affairs Agency (EEAA) to issue its response within 60 days. If no response is received beyond this period, the study is automatically approved. The proponent is informed of the decision, and in the event of an approval, the requiring conditions for both construction and operation phases.

[1] Environmental Procedures, Title 22 of the U.S. Code of Federal Regulations, Part 216 (22 CFR 216).

The proponent has the right to issue an appeal within 30 days from the receipt of the decision. The CAA for this project is the Governorate of Qalyoubia (GOQ).

Proposed developments are classified into three categories according to the severity of potential environmental impacts. The three categories include the following:

- Category A: projects with minor environmental impacts.
- Category B: projects with substantial impacts.
- Category C: projects with high potential impacts.

The EIA should be prepared according to the Egyptian Guidelines for EIAs (EEAA, 1996), which describe in detail the procedures for the preparation of an EIA.

This project is of special nature since remediation and clean-up activities are not classified under EEAA's three categories. Life-Lead has therefore consulted the EIA Unit of EEAA for guidance. Based on the fact that the remediation activities involve the handling, transportation, and disposal of contaminated material, and the project area includes a number of sensitive receptors such as residential areas, schools, and the Ismailia Canal, this project was classified as Category C. A full environmental impact assessment was requested by EEAA.

National environmental regulations relevant to the project are described below. They will be addressed as part of the EIA process.

Air Quality--

With respect to air quality, the Egyptian Law of the Environment (Law 4/1994) regulates the levels of different emissions released to the atmosphere. Article 40 of the Law and Article 42 of its Executive Regulations determine the maximum allowable limits for the concentrations of pollutants resulting from burning of fuels.

In addition, Article 36 of Law 4/1994 and Article 37 of its Executive Regulations identify the maximum allowable limits for exhaust gases from machines, engines, and vehicles.

For ambient air pollutants, Article 35 of Law 4/1994 and Article 34 of its Executive Regulations determine the maximum allowable limits for those pollutants, Table 1.1.

Solid Wastes--

Similar to air quality, the Egyptian Law of the Environment regulates different activities associated with the management of solid waste. Articles 37 of Law 4/1994 and Articles 38 and 39 of the Executive Regulations regulate the collection and transportation of solid waste.

Article 39 of Law 4/1994 and Article 41 of its Executive Regulations set the precautions to be taken during excavation, construction, demolition, or transport of resulting waste and dust in order to avoid wafting.

Law 38/1967 is concerned with cleanliness and sanitation. Also, Law 38/1967's Executive Regulations (Decree 134/1968) regulates the collection, transportation, storage, and disposal of solid waste.

**Table 1.1: Maximum Limits of Outdoor Air Pollutants**
**Annex 5 of the Executive Regulations of Law 4/1994**

| Pollutant | Maximum limit | Exposure period |
|---|---|---|
| Sulphur Dioxide (µg/$m^3$) | 350<br>150<br>60 | 1 hr<br>24 hrs<br>1 year |
| Carbon Monoxide (µg/$m^3$) | 30<br>10 | 1hr<br>8hrs |
| Nitrogen Dioxide (µg/$m^3$) | 400<br>150 | 1 hr<br>24 hrs |
| Suspended Particles, measured as black smoke (µg/$m^3$) | 150<br>60 | 24 hrs<br>1 year |
| Total Suspended Particles (µg/$m^3$) | 230<br>90 | 24 hrs<br>1 year |
| PM10 (µg/$m^3$) | 70 | 24 hrs |
| Pb (µg/$m^3$) | 1 | 1 year |

Noise--

Noise is one of the impacts, which is caused by equipment used for remediating the project site. Therefore, it is important to check the maximum allowable sound level permitted by the Egyptian Law of the Environment, Law 4/1994.

Article 42 of Law 4/1994 and Article 44 of its Executive Regulations determine the maximum allowable limits for sound intensity. Tables 1.2 and 1.3 show the maximum allowable sound levels for different activities and the period of exposure in case of increasing noise level intensity over 90 dB (A), respectively.

**Table 1.2: Maximum Allowable Sound Levels for Different Activities**

| No. | Type of place/activity | Maximum allowable sound level (decibel (A)) |
|---|---|---|
| 1. | Work place with up to 8 hour shifts and aiming to limit noise hazards on sense of hearing | 90 |
| 2. | Work place where acoustic signals and good audibility are required | 80 |
| 3. | Work rooms for the follow up, measurement and adjustment of high performance operations | 65 |
| 4. | Work rooms for computers, typewriters or similar equipment | 70 |
| 5. | Work rooms for activities requiring routine mental concentration | 60 |

**Table 1.3: Period of Exposure in Case of Increasing Noise Level Intensity over 90 dB (A)**

| | | | | | |
|---|---|---|---|---|---|
| Noise intensity level dB (A) | 95 | 100 | 105 | 110 | 115 |
| Period of exposure (hour) | 4 | 2 | 1 | 1/2 | 1/4 |

Hazardous Substances and Wastes--

Hazardous waste management is addressed by Law 4/1994 and its Executive Regulations, stipulating requirements to be implemented in order to ensure the safe handling of this type of waste. Hazardous waste transportation is primarily addressed by point 3 of Article 28 of the Executive Regulations and is presented below:

- Hazardous Waste Transport Permit (Article 28.3A – Executive Regulations). Hazardous waste is to only be transported by transport operators possessing a transport permit. In addition, hazardous waste is only to be transported in transport vehicles owned by entities/operators possessing a transport permit.

- Specifications of Transport Vehicles (Article 28.3A.1&2- Executive Regulations). Hazardous waste transport vehicles are to be equipped with the necessary safety equipment. The vehicles must be in good working condition and suitable for operation and of adequate capacity and have rotation frequency suitable for the quantities of hazardous waste intended for transport.

- Drivers of Hazardous Waste Transport Vehicles (Article 28.3A.3 – Executive Regulations). Drivers of hazardous waste transport vehicles must receive adequate training to be qualified and capable to act in cases of emergency.

- Labelling of Hazardous Waste Transport Vehicles (Article 28.3A.4 – Executive Regulations). Clear and visible labels must be placed on hazardous waste transport vehicles indicating the type of transported waste and the associated hazard as well as action to be taken in cases of emergency.

- Routing of Hazardous Waste Transport Vehicles (Article 28.3B&C – Executive Regulations). Hazardous waste transport routes are to be determined. Any changes in the routing plan requires notification to the Authority for Civil Defence. The concerned competent authority should be notified of the garage address in which the vehicles park as well as the number and date of their licenses. Hazardous waste transport vehicles are not allowed to pass through residential and other populated areas and city centers during daytime.

- Maintenance and Cleaning of Hazardous Waste Transport Vehicles (Article 28.3E – Executive Regulations). Hazardous waste transport vehicles must be continuously washed and cleaned after each use according to the instructions set by the Ministry of Health in coordination with the concerned competent administrative authority.

The stipulations of Law 4/1994 and the Executive Regulations with regards to hazardous waste transportation do not detail the operational procedures to be followed during transport operations, nor the technical specifications for the means of transport for this type of waste. Hazardous waste transportation guidelines were developed by EEAA presenting the operational procedures to be followed for ensuring proper control of transport operations and effective tracking of transported waste; the necessary technical and safety specifications and equipment of the means of transport; as well as the general operational provisions ensuring the safe handling of the waste during the transportation operations.

Protection of Water Resources--

Law 48/1982 and its Executive Regulations focus on protecting potable water and non-potable/agriculture use water from pollution. These waters include the Nile River, all irrigation canals, drains, and lakes. The water quality standards are shown in table 1.4.

**Table 1.4: Water Quality Standards for Fresh Water Bodies**

| Parameter | Limits (mg/l) |
|---|---|
| Color | 100 NTU |
| Temperature | 5°C above normal temp. |
| Total Solids | 500 |
| Dissolved oxygen | Not less than 5 |
| pH | Not less than 7 not more than 8.5 |
| Biological Oxygen Demand (BOD) | 6 |
| Chemical Oxygen Demand (COD) | 10 |
| Organic Nitrogen | 1 |
| Ammonia | 0.5 |
| Oil and Grease | 0.1 |
| Total Alkalinity | Not less than 20 and not more than 150 |
| Sulfates | 200 |
| Mercury compounds | 0.001 |
| Iron | 1 |
| Manganese | 0.5 |
| Copper | 1 |
| Zinc | 1 |
| Detergents | 0.5 |
| Nitrates | 45 |
| Fluorides | 0.5 |
| Phenol | 0.02 |
| Arsenic | 0.05 |
| Cadmium | 0.01 |
| Chromium | 0.05 |
| Lead | 0.05 |
| Selenium | 0.01 |

Work Environment--

Due to the importance of workers health and safety, both the Egyptian Law of the Environment (Law 4/1994) and the Labour Law (Law 137/1981) regulate different issues related to workers at work places. As indicated by Articles 43 to 45 of Law 4/1994, protective equipment must be provided to workers at the project site.

In addition, safety and occupational health issues are addressed by Chapter 5 of Law 137/1981.

### Site Specific Clean-up Levels

Remediation and clean-up goals for lead have not been established in Egypt. Several meetings were held between Life-Lead and the EEAA's Environmental Quality Sector, Hazardous Waste Department, and the Environmental Health Department to discuss and agree on procedures to establish clean-up levels. The consensus was reached that clean-up levels would be set on a site-specific basis determined by the results of baseline human health risk assessment.

A Baseline Human Health Risk Assessment (BHHRA) was conducted for children aged 6 to 12 years old who attend El Shahid Ahmed Shaalan Primary School. In addition, an assessment of the health risk to adults and children in residential areas was conducted using data available from the risk characterization under EEPP in addition to samples collected at residential sites.

Based on results of the Integrated Exposure Update BioKinetic (IEUBK) model and United States Environmental Protection Agency (USEPA) guidance, the proposed risk-based remediation goals (RBRGs) for lead were calculated to meet recommendations of USEPA, limiting exposure to soil lead levels at residential areas/school such that a typical child or a group of similarly exposed children up to 7 years of age would have an estimated risk of no more than a 5 percent probability of exceeding a blood lead level of 10 microgram lead per deciliter[MSOffice2] blood.

At industrial/commercial sites, lead levels are calculated to be protective to the fetus of a pregnant female worker. The levels suggested would provide protection so that no more than 5 percent probability that fetuses exposed to lead would exceed a blood lead level of 10 microgram lead per deciliter blood.

The RBRGs based on 10 percent probability of exceeding a blood lead level of 10 microgram lead per deciliter blood are presented as an upper bound. The resulting RBRGs are shown in Table 1.5.

**Table 1.5: Proposed Risk-Based Remediation Goals (RBRGs) for Lead**

| Media | Residential | School | Industrial |
|---|---|---|---|
| Lead (Pb) in soil (Exterior) | 400-500 mg/kg | 600-800 mg/kg | 1,100-1,500 mg/kg |
| Lead (Pb) in dust (Interior) | 200-300 mg/kg | 300-400 mg/kg | - |

Egypt currently does not have standards for lead in dust wipe samples, so the project has proposed clean-up levels based on USEPA standards. The USEPA has only established dust wipe standards for residential dwellings. These standards are 40 µg/ft$^2$ for floors and 250 µg/ft$^2$ for windowsills. The project proposes to use these standards at the school with the addition of applying the 250 µg/ft$^2$ standard for dust wipe samples from interior and perimeter walls.

As the USEPA has no dust wipe standards for industrial facilities, the project proposes to adapt the residential standards to industrial conditions by increasing them proportionally to the difference between the RBRGs for lead in soil for school and industries. Using this procedure, the project proposes the dust wipe sample clean-up level of 400 to 500 µg/ft$^2$ for windowsills and walls in industrial facilities.

## 1.2 Existing Facilities and Conditions

The following describes the existing conditions at the El Shahid Ahmed Shaalan School and the five secondary lead smelters. The operations and conditions of each facility varies and demonstrates the need for different remediation options.

### 1.2.1 El Shahid Ahmed Shaalan School

The school property encompasses an area of approximately 2,000 square meters (m$^2$) and consists of one four story main building (approximately 450 m$^2$) and playground and landscaped areas (Appendix A, Exhibit 1).

The school was built in 1995 and currently has an enrolment of 774 students between the ages of 6 and 12 years. The school is large enough to accommodate 1,500 students, but enrollment was reduced recently in response to health concerns associated with lead contamination.

### 1.2.2 Awadallah Smelters

Awadallah owns three smelters in Shoubra El Kheima, designated herein as Awadallah Smelter No. 1, Awadallah Smelter No. 2, and Awadallah Smelter No. 3.

Awadallah Smelter No. 1 is located on El Magary Street near Ismailia Canal Road. When operating, it had two rotary furnaces, a refining kettle, and a pipe extrusion facility. The smelter produced an average of 11,000 tons of lead ingots per year. The Awadallah Smelter No. 1 (Appendix A, Exhibit 2) encompasses an area of approximately 1,550 m$^2$. There are two buildings on the property, the administration building and a workers room, occupying approximately 450 m$^2$. The site is surrounded by a brick wall with an entry gate. A metal roof with a skylight, supported by a double row of steel columns placed at irregular intervals, covers most of the smelter site.

Awadallah Smelter No. 2 is located on El Rashah of Ard El Khors wa El Agam near Decorama Street. When operating, it had a rotary furnace and a refining kettle with an average annual production of 9,000 tons (Appendix A, Exhibit 3). The smelter site covers an area of approximate 900 m$^2$. There are three buildings on the property occupying 350 m$^2$. A masonry brick wall surrounds the smelter property with an entry gate on the south wall. A metal roof supported by the perimeter walls and a row of steel centre columns covers the northern third of the property.

Awadallah Smelter No. 3 is located on Rashah Shebeen Street near 15th of May Street. This smelter had two rotary furnaces and a pipe extrusion facility (Appendix A, Exhibit 4). When operating, its average annual production was 15,000 tons. The smelter property covers approximately 3,800 $m^2$. The only building on the property belonging to the smelter is the administration building in the southeast corner of the property which occupies a space of approximately 658 $m^2$.. Part of an electric station extends into the northern boundary of the smelter property and occupies approximately 760 $m^2$. A masonry brick wall surrounds the site.

Awadallah ceased smelting operations at the three smelters in 2001, but continued refining and pipe extrusion operations at Awadallah No. 1 until 2004. In 2004, Awadallah removed all remaining equipment from the sites and performed limited remediation activities. The company reports that at Awadallah No. 1 it excavated the soil to a depth of 1.25 meters, laid down 0.5 meters of sand, and covered the sand with 0.75 meters of concrete. At the other two sites the company reports that the excavation went down to 1.5 meters and that the concrete layer was 1.0 meter thick. The company also reports that it cleaned and painted all surfaces at each site.

### 1.2.3 Seoudi Smelter

The Seoudi Smelter began operations in the late 1980's on land leased from the El Araby family. It became one of the main sources of lead pollution in the project area. The 305 $m^2$ smelter site included one rotary furnace (Appendix A, Exhibit 5). The furnace was not designed according to environmental standards. The filter on the furnace was not properly designed to regulate emissions from the smelter according to the Law 4/1994 requirements. The operation of the smelter was out of compliance with the law, in that the furnace was charged with whole batteries that had not been broken and with the lead separated from their plastic covers. As a result, the smelter was shut-down by the GOQ in 2001 and the land was returned to the El Araby family. At the time of the closure, the smelter equipment was removed from the site.

### 1.2.4 El Mahy Smelter

The El Mahy Smelter property is approximately 1,600 $m^2$. Operations at the smelter started more than 25 years ago using two rotary furnaces, one vibratory furnace for smelting, three kettles for lead refining, and pipe extrusion equipment (Appendix A, Exhibit 6). The three smelting furnaces were fired by heavy fuel (Mazot). In 1999, the owner ceased operation of the furnaces, removed the two rotary furnaces, and confined site activities to refining lead ingots in two refining kettles and extruding the refined lead into lead pipes. Since that time natural gas has been used for firing the kettles.

The smelting process adopted in the smelter lacked environmental controls. The furnaces and kettles had non-standard designs, which resulted in high emissions of fugitive dust during charging and operation. The furnaces were fitted with inadequate filters, and virtually no other proper pollution controls were installed.

## 1.3 Proposed Action

Based on the collected baseline information; site characterization; laws and regulations; future use of the site; and within a national and international policy context (i.e., Law 4/1994 and USAID requirements); a long list of remediation alternatives was proposed to remediate the project sites (Appendix C).

The proposed long list of remediation alternatives, developed for different contaminated media, was subjected to further analysis to identify a short list of remediation techniques that could to remediate the site to the required standards and reduce risks to human health and the environment. The USEPA Evaluation Criteria (USEPA, 1994) were used as a base for this remediation method selection process. These criteria are compliance with applicable or relevant and appropriate requirements, long-term effectiveness and performance; reduction of toxicity; mobility or volume; short-term effectiveness; implementability, and cost.

The following clean-up or remediation alternative was proposed for each site. The construction activities associated with the proposed alternative and the expected operation and maintenance are included in the description of the remediation action.

### 1.3.1 El Shahid Ahmed Shaalan School

**Construction Activities**

Four remediation alternatives were developed for the El Shahid Ahmed Shaalan School. Alternatives 3 was the selected and includes a soft cap in the playground area. Alternative 4 includes the placement of a concrete hard cap on the playground and is being presented as an option in the tendering process. The financial analysis estimated that the present values of the cost of the two alternatives are very close, with Alternative 4 has a slightly higher capital cost, but lower maintenance cost and maybe selected if sufficient funding is available. However, Alternative 3 is the recommended alternative due to funding limitations and consists of the following major activities:

- Controlled dry cleaning of the school building interior, its furniture, and appurtenances, using High Efficiency Particulate Air (HEPA) filter equipped vacuum cleaners.

- Building improvements to limit airborne pollutants from entering the building including coating (painting) walls, ceilings, and floors, and the replacement of windows and doors.

- Disposal of contaminated materials and cleaning residuals in a suitable disposal facility.

- Limited removal of contaminated soil from identified “hot-spots” (to an approximate depth of 50 cm) to address contamination that may exceed action levels.

- Soft or hard capping of the playground area with compacted soil or concrete, respectively.

- Disposal of contaminated soil offsite at a suitable disposal facility and using clean soil to restore excavated areas.

- Conventional site management practices, such as basic hygiene, grounds maintenance, and normal landscaping are recommended to minimize exposure.

Since the school is currently in active use, remediation activities will either need to be conducted during the school's summer break or students and faculty will need to be temporarily relocated during the remediation activities. The remediation activities at the El Shahid Ahmed Shaalan School are scheduled for the period of July through September 2005.

**Operation and Maintenance**

The proposed remediation action posses good short-term effectiveness when building surfaces are properly prepared. Long-term effectiveness will depend on coating maintenance and the ability to control dust from outside sources and/or education/training of students, teachers, and administrators. Long-term maintenance costs may marginally increase the cost of conventional janitorial services and recurring painting costs. As for capping of the playground area, the expected life of the optional alternative 4 hard cap is twenty years, while the proposed Alternative 3 soft capping will need to be replaced annually.

### 1.3.2 Awadallah Smelters

**Construction Activities**

Four remediation alternatives were developed for the Awadallah sites. Alternative 3 is the recommended alternative and consists of the following major activities:

- Implement institutional controls, such as zoning, to restrict site land uses to commercial or industrial.

- Restrict the use of groundwater in the vicinity of smelters (well registration).

- Apply deed restrictions indicating environmental liabilities.

- Implement engineering controls (e.g., fencing) to restrict public access.

- Decontaminate remaining structures and encapsulate (coat).

- Dispose limited excavated soil as non-hazardous (assumes passes Toxicity Characteristic Leaching Procedure (TCLP) test or local equivalent).

- Establish long-term site management plans to manage covered-in-place (existing) contamination.

The remediation activities at the three Awadallah sites will commence in December 2005 or early January 2006 and will require approximately six weeks for completion.

### Operation and Maintenance

The proposed remediation actions posses good short-term effectiveness when building surfaces are properly prepared. Long-term effectiveness will depend on coating maintenance and ability to control dust from outside sources, and/or occupants education/training. With limited clean-up offsite and capping, long-term effectiveness will be protective of worker health and safety in the facility under the proposed new use.

### 1.3.3 Seoudi Smelter

### Construction Activities

Four remediation alternatives were developed for the Seoudi site. Alternative 4 is the recommended alternative and consists of the following major activities:

- Implement institutional and engineering controls.
- Excavate contaminated soil to achieve health-based clean-up objectives within practical site constraints and treat excavated soil using soil stabilization methods.
- Backfill excavation with structural backfill and seal with an impermeable concrete cap.
- Dispose excess stabilized soil offsite as non-hazardous waste in a non-regulated facility.
- Decontaminate remaining structures and surfaces encapsulated (e.g., painted) or demolished. Structural limitations will be considered in support of in-place wall decontamination.
- Control and appropriately handle decontamination fluids.
- Develop and implement a long-term site management plan.

The remediation activities at the Seoudi site will commence in January 2006 and will require approximately twelve weeks to complete.

### Operation and Maintenance

The proposed remediation action posses good effectiveness. Contaminated soil is treated on site to meet non-hazardous leaching characteristics, part of the soil is used for fill and the remaining is removed from the site and disposed in a non-regulated land disposal facility. Onsite exposure to residual contamination is limited by encapsulation of structure surfaces and isolation of residual contamination remaining in the soil. The concrete cap typically requires some level of long-term monitoring including institutional controls.

### 1.3.4 El Mahy Smelter

### Construction Activities

Four remediation alternatives were developed for the El Mahy site. Alternative 4 is the recommended alternative and consists of the following major activities:

- Implement institutional and engineering controls.

- Excavate contaminated soil within practical site constraints and treat excavated soil onsite by soil stabilization methods and/or Backfill excavation with structural backfill and seal it with a concrete cap. The selected option will depend on available funding and the final evaluation of both short and long-term costs.

- Dispose excess stabilized and/or excavated soil offsite as non-hazardous waste in a non-regulated facility. The top layer of contaminated soil may be processed at another smelting facility.

- Decontaminate remaining structures and encapsulate surfaces (e.g., coating) or demolish and dispose offsite.

- Remove/demolish existing equipment and decontaminate and disassemble along with scrap piles for possible offsite recycling or disposal.

- Control and appropriately handle decontamination fluids.

- Develop and implement a long-term site management plan.

The remediation activities at the El Mahy site will commence in January 2006 and will require approximately 12 weeks to complete.

**Operation and Maintenance**

The proposed remediation action posses good effectiveness. Contaminated soil is treated on site to meet non-hazardous leaching characteristics, part of the soil will be used for backfill and the rest removed from the site and disposed in a non-regulated land disposal facility. Onsite exposure to residual contamination is limited by encapsulation of structure surfaces and isolation of residual contamination remaining in soil. The concrete cap typically requires some level of long-term monitoring, including institutional controls.

## 1.4 Project Alternatives

All proposed alternatives (except the no action alternative) are capable of meeting the health based clean-up goals of the project. The no action alternative is proposed to provide a comparison of the benefits provided by the remediation alternatives. The alternatives selected for each of the sites are described in Section 1.3 above. The following provides a summary description of the other alternatives evaluated.

### 1.4.1 El Shahid Ahmed Shaalan School

The following alternatives were developed for the El Shahid Ahmed Shaalan School:

- **Alternative 1: No Action.**

- **Alternative 2: Interior School Cleaning and Site Management.** Alternative 2 includes the same activities of the proposed action described in Section 1.3.1 except that it does not include soil remediation and wall painting.

- **Alternative 3: Interior School Cleaning/Coating, Limited Soil Removal/ Soil Covering and Site Management.** This is the proposed action described in Section 1.3.1.

- **Alternative 4: Interior School Cleaning/Coating, Soil Capping, Landscape and Site Management.** Alternative 4 includes the same activities of Alternative 3 except the playground area will be covered with a 10 to 15 cm of hard concrete cap. Covered areas will be re-developed consistent with school recreational uses.

### 1.4.2 Awadallah Smelter Sites (3 smelter sites)

The following alternatives were proposed for the Awadallah Smelters:

- **Alternative 1: No Action.**

- **Alternative 2: Institutional / Engineering Controls, Decontaminate Structures.** Alternative 2 includes the same activities of the proposed action in Section 1.3.2 except that it does not include soil remediation and covering traffic areas.

- **Alternative 3: Institutional/Engineering Controls, Decontaminate Structures, Excavate/Dispose Limited Soil Offsite, Cover Traffic Areas.** This is the proposed action described in Section 1.3.2.

- **Alternative 4: Institutional / Engineering Controls, Decontaminate Structures, Excavate/Dispose Limited Soil Offsite, Cap Traffic Areas.** Alternative 4 includes the same activities of the proposed action except that the traffic areas will be capped with an asphalt concrete layer. It also involves coordination with the GOQ to implement other improvements including an asphalt concrete cap as part of residential improvement and protection road paving program (work funded by others).

### 1.4.3 Seoudi Smelter

The following alternatives were developed for the Seoudi Smelter:

- **Alternative 1: No Action.**

- **Alternative 2: Institutional/Engineering Controls, Decontaminate Structures and Debris, Limited Soil Removal and Capping.** Alternative 2 is similar to the proposed action described in Section 1.3.3 except that soil excavation is limited to approximately 25 cm depth.

- **Alternative 3: Institutional/Engineering Controls, Decontaminate Structures and Debris, Excavate/Dispose Offsite as Hazardous Waste.** Alternative 3 is similar to the proposed action described in Section 1.3.3 except that there will be no soil stabilization. The excavated soil will be disposed offsite as hazardous waste in a regulated facility and excavation will be backfilled with structural backfill and sealed with an impermeable cap.

- **Alternative 4: Institutional/Engineering Controls, Decontaminate Structures and Debris, Excavate/Stabilize/Dispose Offsite as Non-Hazardous Waste.** This is the proposed action described in Section 1.3.3.

### 1.4.4 El Mahy Smelter Site

The following alternatives were developed for the El Mahy Smelter:

- **Alternative 1: No Action.**

- **Alternative 2: Institutional/Engineering Controls, Decontaminate Structures, Equipment, Piles/Remove Equipment.** Alternative 2 is similar to the proposed action described in Section 1.3.4 except that it does not include soil remediation.

- **Alternative 3: Institutional/Engineering Controls, Decontaminate Structures, Equipment, Piles/Remove Equipment, Excavate/Dispose Offsite as Hazardous Waste/Cap.** Alternative 3 is similar to the proposed action described in Section 1.3.4 except that there will be no soil stabilization. The excavated soil will be disposed offsite as hazardous waste in a regulated facility and the excavation will be backfilled with structural backfill and sealed with an impermeable cap.

- **Alternative 4: Institutional/Engineering Controls, Decontaminate Structures, Equipment, Piles/Remove Equipment, Excavate/ Stabilize /Dispose Offsite as Non-Hazardous Waste/Cap.** This is the proposed action described in Section 1.3.4.

# 2. ENVIRONMENTAL SETTING

## 2.1 Introduction

### 2.1.1 Field Study Methodology

The following activities were performed in order to obtain data and information on the environmental setting of the project area and its surroundings. The data obtained were then used to prepare for the site visits and identify environmental conditions to be further investigated.

#### Literature Review

Data on the environmental characteristics of the region and the project area were first gathered through desk studies. The literature review was then supported by the analysis of recent topographic maps and satellite images.

#### Field Visits

Field visits were carried out to get familiarized with the project area and to obtain information on the site-specific environmental conditions identified earlier from the literature review. During these visits baseline data were collected, and the main environmental characteristics and components[MSOffice3] of the area were identified.

**Consultation with Local and Governmental Authorities**

Meetings and coordination with governmental agencies, NGO's, smelter owners and others were held to facilitate the sampling and site characterization phase of the project and to collect primary data for the Environmental Assessment.

### 2.1.2 Life of Project

The Life-Lead project is a two-year project. It was initiated on August 18, 2004 and the expected completion date is August 17, 2006. Within the two years, remediation activities will take place at the five smelter sites and the school.

### 2.1.3 Definition of Study Area

The Study Area includes those areas that will be subject to direct and indirect impacts of the project and the implemented alternatives. The area that will be directly impacted by remediation and clean-up activities includes properties adjacent to the five smelters and the school.

Previous characterization activities in Shoubra El Kheima, Qalyoubia have focused on an area within a one-kilometer radius of the Awadallah Smelter No.1. For purposes of this EA, the Study Area is defined as the area within a one-kilometre radius circle centred on the former Awadallah Smelter No.1 as shown in Figure 1.1. The various land uses and associated potential receptors within this Study Area are considered in this EA and include the following:

- On site receptors such as soil and workers.
- Receptors impacted by ambient air, noise, and public health surrounding the site.
- Final sinks/receptors such as surface and groundwater.

The primary focus of this EA is on the environmental and health effects due to exposure to lead suspected to originate from the five secondary lead smelters within the Study Area during the different clean-up activities.

## 2.2 <u>Current Land Use</u>

### 2.2.1 El Shahid Ahmed Shaalan School

The school is located in the southern portion of the GOQ on the Ismailia Canal Road, Shoubra El Kheima (Appendix A, Exhibit 7). The school is bordered on the north by an unpaved road and a foundry, Ismailia Canal Road on the south, El Shaboura Canal Street on the east, and a soccer field on the west. At the time of construction, the school was designed to accommodate approximately 1,500 students between the ages of 6 and 12 years.

### 2.2.2 Awadallah Smelters

Awadallah smelters are located in the southern portion of the GOQ near the Ismailia Canal.

The location of each smelter is provided below.

**Awadallah Smelter No. 1**

Awadallah Smelter No. 1 is located on El Magary Street near the Ismailia Canal Road (Appendix A, Exhibit 8). The land use in the immediate vicinity of the smelter is a mixture of residential, industrial, and public uses. However, there is agricultural land within 0.5 kilometers of the smelter. To the west of the smelter are a number of functioning smelters producing cast iron, copper, and aluminum. To the north of the smelter is the Modern Industry Factory, which produces metal pots and pans for cooking. To the south there is a mosque and a youth center.

**Awadallah Smelter No. 2**

Awadallah Smelter No. 2 is located in the Ard El Khors Wa El Aguam area on El Rashah Street off the Ismailia Canal Road (Appendix A, Exhibit 9). Land use in the vicinity of the smelter is a mixture of industrial and residential. However, agricultural land is located within 0.5 kilometers of the smelter. To the north and west of the smelter site are operating iron smelters. About 250 meters to the east of the site is the Seoudi Secondary Lead Smelter. To the west of the smelter is a plant nursery and immediately west of the nursery are residential dwellings. Residential dwellings are also located south of the property.

**Awadallah Smelter No. 3**

Awadallah Smelter No. 3 is located on Rashah Shebeen Street near the intersection with 15th of May Street (Appendix A, Exhibit 10). Land use in the vicinity of the smelter is a mixture of residential, industrial, and agricultural. To the north and west of the site there are textile factories including dye houses. Next to the factory on the west is a residential area. The Egyptian Automotive Company lies to the south of the smelter. To the east is a residential area.

### 2.2.3 Seoudi Smelter

The Seoudi Smelter is located in a mixed industrial and residential area on Decorama Street just south of Ismailia Canal Road (Appendix A, Exhibit 9). Land use in the vicinity of the smelter is a mixture of industrial and residential. However, agricultural land is located within 0.5 kilometers of the smelter. About 250 meters to the east of the site is the Awadallah Smelter No. 2.

### 2.2.4 El Mahy

The El Mahy Smelter is located on Tereet El Shaboura Street near the Ismailia Canal Road in a mixed residential and industrial area (Appendix A, Exhibit 11). The land was previously used as a brick factory. The northern border of the El Mahy site is bordered by El Ahleya Company for Pipe Manufacturing and Misr Company for Reinforced Concrete Works to the west. To the east, the site overlooks the North Cairo Mill. To the northeast there are newly established residential buildings.

### 2.2.5 Waste Transportation Routes

Contractors will be responsible for transportation of waste generated from the remediation actions. The non-hazardous waste generated from remediation will be disposed in the Abu Zabaal Landfill. The waste will travel from Shoubra El Kheima to Abu Zaabal along the Ismailia Canal Road for approximately 25 km. The route passes through agricultural land and next to industrial sites and the Abu Zabaal Prison near the landfill (Appendix A, Exhibit 12).

The hazardous waste will be disposed in the Nasereya Hazardous Waste Landfill. The waste will travel from Shoubra El Kheima to Nasereya along the Ring Road and then the Alexandria Desert Road for approximately 200 km. The route crosses the Nile River and passes through agricultural land in route to the landfill (Appendix A, Exhibit 12).

## 2.3 Socio-Economic Conditions

### 2.3.1 Demography

The population in Hai Shark (East District) of Shoubra El Kheima increased from 454,000 in 1996 to 536,900 in 2001 with an annual population growth rate of 3.7 percent. This annual growth rate is higher than in the city, governorate, or in Egypt as a whole.

The population of concern is 182,096 residents in the immediate Study Area, which is defined as a circle with a radius of one kilometer around Awadallah Smelter No. 1. The population inhabiting this area is distributed among four administrative subdistricts: Mostorod, Bahteem, Masaken El Amiria, and El Zawya El Hamra. Approximately 20 percent of the population in Mostorod, Bahteem, and El Zawya El Hamra and 80 percent of the population in Masaken El Amiria are located within the Study Area. Table 2.1 presents population estimates for the Study Area including estimates for some of the sub-populations that are at highest risk from lead contamination.

**Table 2.1 Estimated Population in the Study Area by Age and Sex**

| | Mostorod | Bahteem | Masaken El Amiria | El Zawya El Hamra | Total |
|---|---|---|---|---|---|
| Total Population | 17,946 | 72,845 | 40,097 | 51,208 | 182,096 |
| Children up to 7 years | 4,845 | 19,668 | 10,826 | 13,826 | 49,165 |
| Females of reproductive age (15 – 49 years) | 4,487 | 18,211 | 10,024 | 12,802 | 45,524 |

### 2.3.2 Economic Activities and Employment

The major economic activities in Hai Shark are industry and services (UNDP HDR, 2003). Nearly 45 percent of the labor force in the Hai Shark is in the industrial sector, 43 percent in the services sector, and 12 percent in the agricultural sector. One third of the total labor force and one half of the women in the labor force work for the government or in the public sector (which cuts across the other three sectors). The labor force comprised 25.2 percent of the total population in the Hai Shark in 2001. Men comprise 88.7 percent of the labor force and most people in the labor force are primary wage earners (78.8 percent).

Overall unemployment in the Hai Shark is relatively low (5.6 percent of the labor force), but is twice as high for women (12 percent) and adults from ages 15 to 29 (11.2 percent). However, all of these unemployment rates are lower than the rates for the city of Shoubra El Kheima, the GOQ, and Egypt as a whole.

### 2.3.3 Quality of Life Indices

#### Life Expectancy and Mortality Rates

According to official data, life expectancy at birth for Hai Shark in 2001 is 68.0 years. Such average shows to be slightly higher than Shoubra El Kheima (67.6 yr) and total of Egypt (67.1 yr), but is still lower than the total for the GOQ (68.5 yr). Infant mortality and maternal mortality rates for Hai Shark are12.7 per 1,000 and 22.0 per 100,000, respectively. Infant mortality and maternal mortality rates for Shoubra El Kheima are 12.7 per 1,000 and 23.0 per 100,000, respectively, and are significantly lower than the total GOQ figures of 17.7 per 1,000 and 30.3 per 100,000, respectively.

Infant mortality measures suffer from under-registration. Therefore, the registered and adjusted infant and under 5 mortality rates are calculated. Registered infant mortality rates in Hai Shark reached 12.3 per 1,000 births in 2001; this was adjusted to 12.7 in 2000. While registered under 5 mortality rates reached 19.5 per 1,000 births in 2001 and were adjusted to 20.0 in 2000.

#### Maternal Care and Child Survival

As registered in 2001, more than half of pregnant women in Hai Shark and Shoubra El Kheima City get prenatal care (52.4 and 52.9 percent, respectively). Births in Hai Shark and Shoubra El Kheima were under the supervision of health personnel 56.3 and 56.9 percent of the time, respectively. Records indicate that approximately 87.1 and 87.9 percent of children born were breastfed in Hai Shark and Shoubra Al Kheima City. Such rates are lower than the total of the GOQ and Egypt. In contrast, data indicates that only 2.7 and 2.9 percent of children under 5 in Hai Shark and Shoubra Al Kheima City are underweight compared to 3.6 and 8.8 percent in the GOQ and Egypt, respectively.

### 2.3.4 Transportation and Support Services

Data on the road infrastructure is only available from Shoubra El Kheima City. Available information illustrates that a total of 121 km of paved roads covers 12 km of highways, 17 km of main roads, 28 km of regional roads, and 64 km of internal roads. Unpaved roads cover a total of 178 km (IDSC, 1998).

In the area of Shoubra El Kheima, there is only one water plant. While total water production rates reaches 200, 000 $m^3$/day, the total consumed amount is approximately 190,000 $m^3$/day. Domestic water consumption per capita is estimated to be 190.18 liters/day (IDSC, 1998).

With respect to sanitation, there are seven sanitation plants in the area of Shoubra El Kheima. Total capacity of these plants is estimated at 350,000 $m^3$/day, with a total per capita of 380 liters/day (IDSC, 1998). In 2001, households with access to sanitation reached 98.7 percent of the total population (EHDR, 2003).

### 2.3.5 Education, Health, and Social Services

#### Literacy and Education Levels

Total and female literacy rates (15+) in Hai Shark reached 72.6 and 62.8 percent, respectively. In Shoubra El Kheima City, the total and female literacy rates are 75.7 and 66.6 percent, respectively, and are relatively higher than the GOQ and Egypt in 2001. However, gross enrollment ratios in primary, preparatory, and secondary schools in Hai Shark remains lower than the average in the City, Governorate, and Egypt in 2000/2001. More than 23 percent of the Hai Shark population has secondary or higher education which is similar to the total in Egypt.

#### School Enrollment

Official data for Hai Shark in 2000/2001 shows that gross enrolment ratio in 1st, 2nd, and 3rd level is 33.2 percent. On the other hand, the basic and secondary enrollment ratio is 72.6 percent for all students and 68.8 percent for females. With the absence of Azhar Schools in Hai Shark, 91.9 percent of the total pupils go to governmental schools and only 8.1 percent go to private schools. Secondary technical enrollment represents 74.1 percent of the total secondary enrollment (EHDR, 2003).

#### Education Imbalances

According to the official data for Hai Shark in 2000/2001, class density is 39.9 pupils in primary schools with a rate of 21.6 pupils per teacher. Imbalances in preparatory schools are much higher as class density reaches 56.1 pupils with a total of 33.1 pupils per teacher. Moreover, a total of 7.3 percent of all school buildings are completely unfit and in need of repair (EHDR, 2003).

#### Education Services

Data on education services in terms of number of schools, institutes, classes, pupils, and teachers is only available for Shoubra El Kheima City. There are approximately 78 public primary and 45 public preparatory schools in Shoubra Al Kheima City (IDSC, 1998). These schools include a total of 182,884 pupils enrolled in basic education. In addition, a total of 45,716 pupils are enrolled in secondary schools.

#### Health Services

Health services in Hai Shark and Shoubra El Kheima City fall within the average of the total for the GOQ. The exception is the number of physicians and nurses per 10,000 people, which shows to be significantly higher in the GOQand the total for Egypt. The nurse/physician ratio in Hai Shark and Shoubra El Kheima City is 238.8 percent and is significantly lower than the ratio in total for the GOQ which is 287.6 percent. However, the ratio is significantly higher than the ratio for Egypt which was 224.4 percent in 2001.

The Information Decision Support Cabinet (IDSC), Statistical Book of 1998 indicates a wide range of health services in Shoubra El Kheima City. These include different public centers, units, offices, praxes, laboratories, and hospitals affiliated to the Ministry of Health with a total of 69 units. At the same time, 60 of the total are considered day care centers with no facilities for inpatients, while only 4 are equipped for inpatients (IDSC, 1998).

### Social Services

There are almost 10 social units in Shoubra El Kheima City, where the ratio of units per 1,000 people reached 92.02 in 1998. The total number of Non Governmental Organizations (NGOs) reached about 127 organizations, where the ratio of organizations per 1,000 people reached 7.25 in the same year. Activities undertaken by NGOs includes a total of 172 "productive family projects" (i.e., income generation enterprises for poor households), 4 women clubs, 47 nurseries, and 3 children clubs.

Youth centers in the Shoubra El Kheima City are estimated at 12 centers, 10 sport clubs, and one sport committee. The ratio of total youth organizations per 1,000 people reached 40.01 in 1998. These organizations provide various activities in the field of culture, religion, camping, arts, and public works.

### Religious Services

The Information Decision Support Cabinet (IDSC) data shows that there were 39 governmental mosques and 183 civil mosques in 1998. These figures indicate active involvement of the civil society in the area. The number of churches in the city was estimated at 7 institutions in 1998 (IDSC, 1998).

## 2.4 Physical Environment

### 2.4.1 Climate

According to meteorological records, Table 2.2, and data from the Climatic Atlas of Egypt, EMA, (1996), the climatic features of the project area are characterized by the following:

- The annual mean air temperature is approximately 19.9 °C and the average monthly temperature reaches its maximum value in July and August (26.9 °C) and its minimum value in January (11.2 °C).
- The average annual relative humidity is about 68 percent, and the average monthly relative humidity reaches its maximum value in December (81 percent) and its minimum value in May (53 percent).
- Rainfall is very limited. The average annual rainfall is approximately 25.5 mm. The majority of the rainfall is limited to three months (December through February), with the highest in December. Annual rain days are very few and storms occur occasionally and are usually of short duration.
- The dominant winds over the year have a northern component with an annual mean velocity of 12.27 km/h. The dominant winds over the winter season trend SSW, S, and SW. The affecting dominant winds over the summer period are multidirectional and trend NNW, N, and NNE. In transitional periods (spring and autumn), the winds trend dominantly in N and NNE directions.

**Table 2.2: Meteorological Records**

| Climatic Parameters | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. | Annual Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean Daily Temperature (°C) | 11.2 | 12.5 | 15.4 | 19.2 | 23.3 | 26 | 26.9 | 26.7 | 24.3 | 22 | 18 | 12.3 | 19.9 |
| Mean Daily Relative Humidity (%) | 79 | 72 | 67 | 60 | 53 | 56 | 62 | 68 | 72 | 73 | 78 | 81 | 68 |
| Average Wind Speed (km/h) | 7.6 | 8.6 | 9.8 | 9.9 | 10.5 | 10.5 | 9.7 | 9.6 | 9.4 | 8.2 | 7.4 | 6.8 | 9 |
| Prevailing Wind Direction | SSW | SSW | NE | NE | NE | NNE NW | NW | NNW | N | NE | NE | SW | |
| Monthly Rainfall (mm) | 4.5 | 4 | 3.5 | 2 | 1.5 | 0 | 0 | 0 | 0 | 2.5 | 2.5 | 5 | Total:25.5 |

Source: Egyptian Meteorological Authority, 1996

The wind roses, Figure 2.1, represent the percentage ratio of the frequencies of occurrence of wind (the length of the column) blowing from a certain direction. The different parts (with different colours and widths) of the column represent the wind speed range in knots. The number in the circle represents the percentage ratio of calm wind frequency multiplied by 10. Table 2.3 gives the distribution of wind direction throughout the year.

**Table 2.3: Distribution of Wind Direction throughout the Year**

| Wind Direction | Velocity (Km/hr) | Percentage |
|---|---|---|
| Calm Wind | 0 | 4.04 |
| North | 9.76 | 13.79 |
| North-east | 13.82 | 50.7 |
| East | 11.78 | 1.3 |
| South-east | 5.87 | 0.87 |
| South | 8.79 | 4.02 |
| South west | 12.8 | 7.82 |
| West | 14.52 | 5.26 |
| North-west | 13.05 | 12.2 |
| **Average Wind Velocity** | **12.27** | |

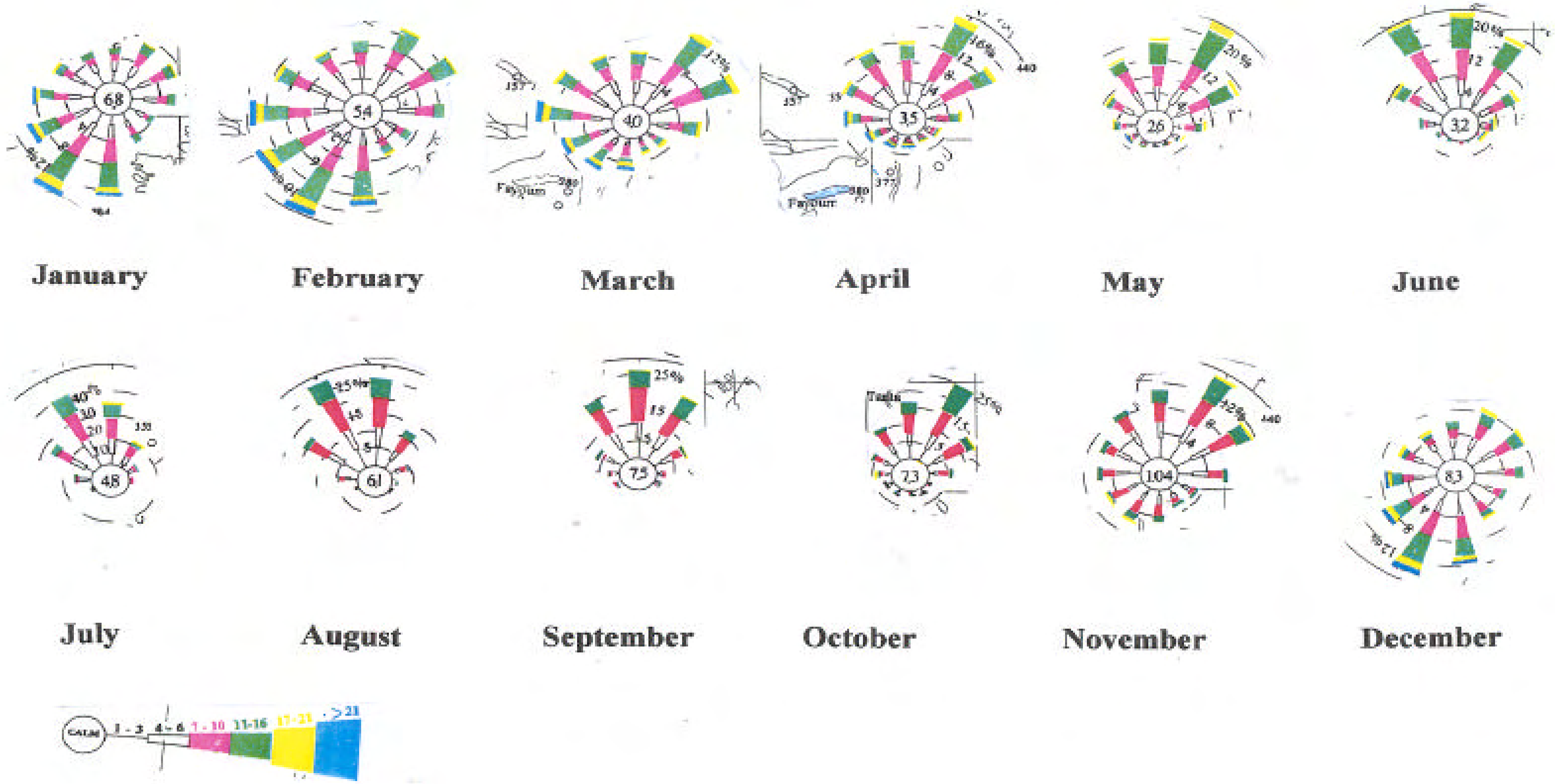



**Figure 2.1: Mean Monthly Wind Roses Recorded at the Cairo Station (Egyptian Meteorological Authority, 1996)**

### 2.4.2 Geology and Hydrogeology Characteristics

The area where the project is located is within the flood plain of the Nile River. The topography of the area is almost flat with an average altitude of 17 m above mean sea level.

The area, in general, is a part of the Northern tip of the Nile Delta and alluvial plain, which consists of silty and sandy clay deposits (Holocene-Q3) that overlay the graded sand and gravel Pleistocene aquifer (Pleistocene-Q1). The main aquifer belongs to the Quaternary formation that is a Nile River recharged formation. The Holocene (Q3) layer is about 15 m thick and the thickness of the Pleistocene (Q1) is not definitely known but extends beyond 200 m deep. The layers forming the aquifer can be classified into the following:

- A clay cap that is the surface layer over the aquifer, formed from clay precipitants that belong to the Holocene Era. The thickness of this layer ranges from 2 to 10 m. This semi-permeable layer allows for water penetration to the aquifer. The vertical permeability of this layer depends on several conditions including the following:

    - The permeability factor to the vertical direction.
    - The thickness of the surface layer.
    - The layer sequence.
    - Piezometric pressure difference between the groundwater and the free water surface level in the clay layer.

- Sand and gravel layers of the aquifer follow the surface layer. The thickness of this layer ranges from 100 to 130 m. Previous studies indicated that the average hydraulic conductivity is 30 m/day and the average transmissivity is 1,000 $m^2$/day.

- The lower clay layer, where it exists, below the aquifer consists of very rigid clay and is considered to be very impermeable.

The main groundwater flow is from the south to the north and from west to east. There are some secondary movements due to some depletion in the groundwater level due to excessive pumping. The main sources of groundwater recharge in the Study Area are the Nile River and the Ismailia Canal. Seepage from the sewage system and drainage networks are the secondary recharge sources. The groundwater discharge is mainly from the groundwater wells.

Underlying the smelters and the school there are two hydrogeologic units, an upper silt and clay layer, and a major alluvial aquifer. The water table is between 5 and 6 m below the ground surface. Two hundred meters to the south of the site is the Ismailia Canal, which is a source of recharge to the aquifer.

### 2.4.3 Air Quality and Noise

#### Air Quality

During the period from October 1998 to July 1999, high particulate matter (PM)10, PM2.5, and lead were detected (CAIP,2002). PM and lead were monitored in 36 sites in Greater Cairo. The results indicated that, in the industrial area of Shoubra El Kheima, the highest mean inhalable PM was found to be 313 $\mu g/m^3$ exceeding the allowable limit of Law 4/1994 of 70 $\mu g/m^3$ by more than 4 fold. Lead concentrations of 26 $\mu g/m^3$ were recorded which also exceeded Law 4/1994 annual average of 1.0 $\mu g/m^3$.

In 2004, air quality in the Shoubra El Kheima industrial area was improved, where the mean PM10 levels dropped to 178 $\mu g/m^3$. In addition, lead levels dropped to 1.02 $\mu g/m^3$ which nearly meets the Law 4/1994 annual average of 1.0 $\mu g/m^3$ (EEPP, 2004).

### Noise

A survey was carried out in the project area to acquire baseline data for the ambient noise levels in the project area. Fourteen monitoring locations were chosen next to the main noise sources as well as the sensitive receptors around each of the smelters and the school as shown in Appendix A, Exhibits 6 through 10.

Measurements were taken during the day, evening, and night as per the requirements of Law 4/1994. Each reading was repeated 3 times to reflect different local conditions (e.g., no, lite, and heavy traffic). The results of the survey are presented in Table 2.4. The following can be concluded from Table 2.4:

- Noise readings were generally within the legal limits during periods of low and lite traffic throughout the day.

- During periods of heavy traffic, the noise levels exceeded the limits, regardless of the time of the day.

- Noise readings taken during the daytime and evening were higher than night readings due to the presence of traffic.

- Noise levels detected at the existing noise sources (factories and workshops) were found to be higher than those detected at the existing receptors (residential areas).

- Noise readings were highest along the Ismailia Canal Road.

**Table 2.4: Results of Baseline Noise Monitoring Survey**

| Location | | Measured Noise Level, dB(A) and Noise Limit | | |
|---|---|---|---|---|
| | | Day time | Evening | Night |
| | | 7 am – 6 pm | 6 pm – 10 pm | 10 pm – 7 am |
| **Awadallah Smelter No. 1** | | | | |
| 1 | Salim Youth Center South of the Awadallah Smelter No. 1 | 52, 60, 68 | 51, 53, 60 | 48, 50, 53 |
| 2 | Smelters Area North of the Awadallah Smelter No. 1 | 51, 56, 60 | 50, 54, 60 | 47, 50, 52 |
| **El Shahid Ahmed Shaalan School** | | | | |
| 3 | In front of the Primary School | 51, 58, 71 | 52, 56, 58 | 46, 49, 54 |
| 4 | Residential Area North of the School | 52, 56, 66 | 48, 51, 60 | 45, 47, 55 |
| **Awadallah Smelter No. 2** | | | | |
| 5 | Illegal Housing Area South of Awadallah Smelter No. 2 | 57, 60, 62 | 48, 52, 63 | 48, 50, 52 |
| 6 | Decorama North of Awadallah Smelter No. 2 | 56, 60, 63 | 45, 47, 50 | 46, 48, 50 |
| **Seoudi Smelter** | | | | |
| 7 | South of the Seoudi Smelter | 53, 61, 66 | 52, 56, 58 | 46, 50, 53 |
| 8 | West of the Seoudi Smelter | 55, 60, 63 | 51, 55, 60 | 46, 48, 51 |
| **Awadallah Smelter No. 3** | | | | |
| 9 | In front of the Egyptian Automotive Co., South of Awadallah Smelter No. 3 | 50, 54, 70 | 48, 52, 65 | 47, 50, 52 |
| 10 | At residential Area East of Awadallah Smelter No. 3 | 50, 55, 70 | 51, 52, 58 | 46, 49, 52 |
| 11 | El Arabiya Dye House North of Awadallah Smelter No. 3 | 55, 58, 67 | 50, 52, 64 | 47, 49, 53 |
| **El Mahy Smelter** | | | | |
| 12 | At residential Area North of the El Mahy Smelter | 50, 60, 66 | 53, 56, 58 | 46, 50, 52 |
| 13 | On Ismailia Canal Road South of the EL Mahy Smelter | 52, 59, 70 | 53, 55, 57 | 48, 50, 53 |
| 14 | Ismailia Canal Road in front of Misr Company for Concrete Works | 53, 57, 71 | 51, 55, 60 | 45, 48, 56 |
| **Law Limit for Dwelling Zone Including Workshops or Public Road** | | **50-60** | **45-55** | **40-50** |

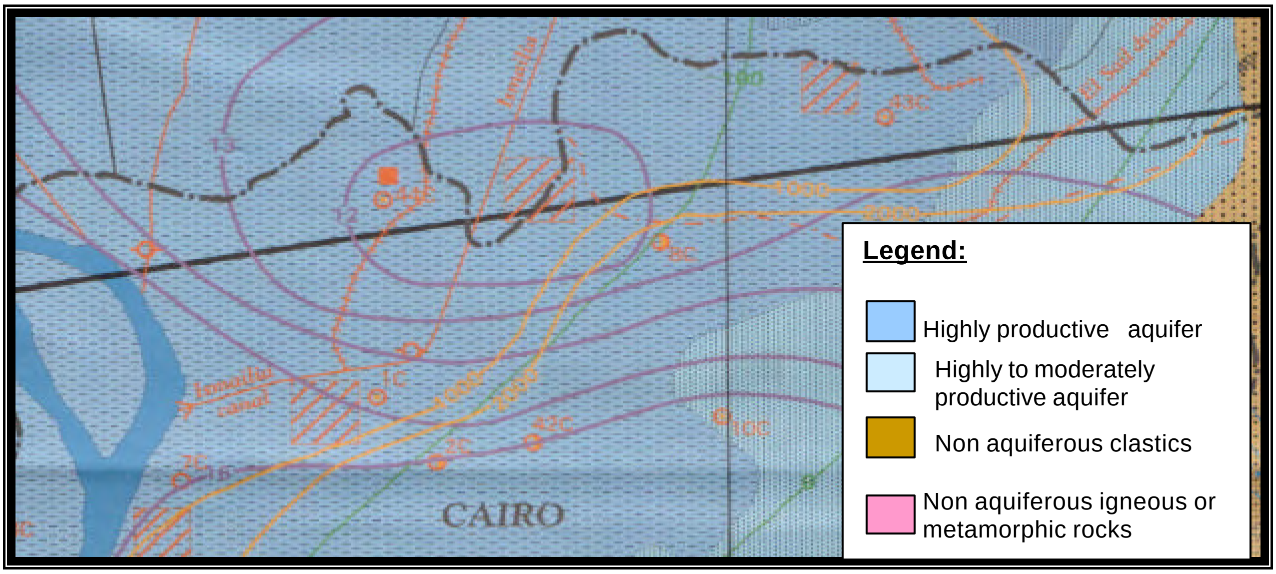
## 2.4.4 Water Supply and Quality

### Groundwater Water Supply

Generally, the aquifer in Shoubra El Kheima is highly productive. The aquifer is continuously recharged from the Ismailia Canal and from the Nile River, the contribution of rainfall to aquifer recharge is minor. The groundwater is highly abstracted in this area.

Figure 2.2, shows the hydrological map of Shoubra El Kheima. The industrial water wells are used only for industrial purposes and not a potable water source. Potable water is provided to all residents and industries by the GOQ.

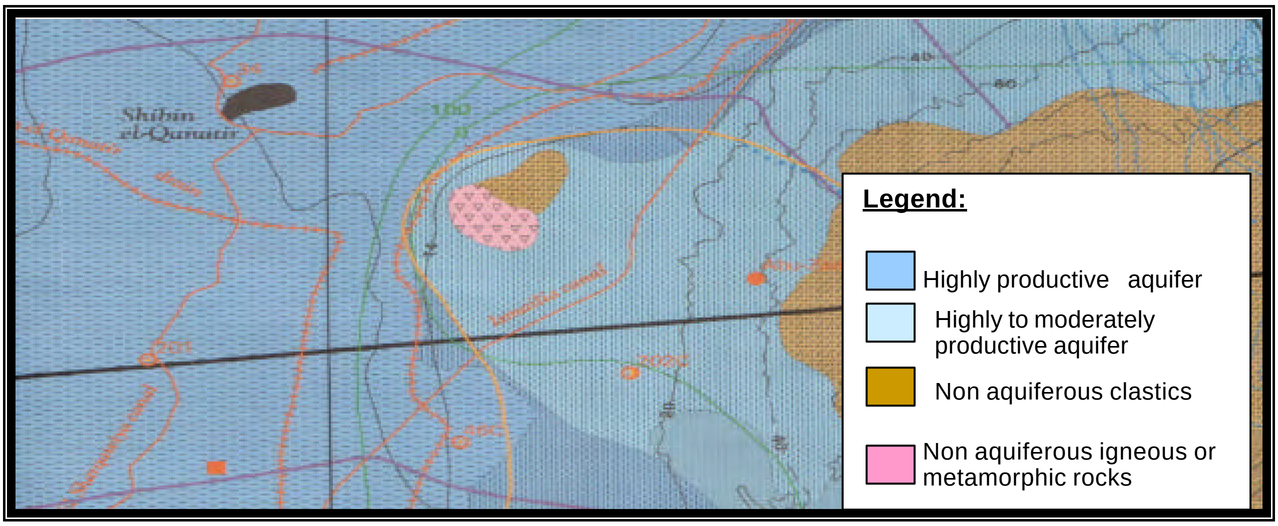
**Figure 2.2: Hydrological Map of Shoubra El-Kheima**




The aquifer in the Abu Zaabal area is highly to moderately productive consisting of quaternary graded sand and intercalated by clay lenses. The aquifer is occasionally recharged from rainfall, surface runoff, and/or irrigation water.

At the landfill, the area is formed of non-aquiferous ingeous or metamorphic rocks and non aquiferous clastics consisting of tertiary clay and shale. Local groundwater occurs in fissured and weathered zones. The main lithology in the area of the landfill is either coarse sands and gravel with limestone interbeded (Miocene "Tm") or basalt (Oligocene "To"). Figure 2.3, shows the hydrological map of Abu Zaabal.

**Figure 2.3: Hydrological Map of Abu Zabaal**



### Surface Water Supply

The nearest surface water to the project site is the Ismailia Canal which is located within 100 meters of the school. The Ismailia Canal is a source of recharge to the aquifer as well as a source of drinking water.

### Groundwater and Surface Water Quality

The water quality standards for both surface and ground water bodies are set in Article No. 60 of the Minister of Irrigation Decree No. 8/1983. The decree sets the Executive Regulations of the Law 48/1982 concerning the protection of the Nile River and water streams (Table 1.4).

### Water Sampling and Analysis Program

A water and sediment sampling program was carried out at Shoubra El Kheima and Abu Zabaal. The main objective was to evaluate current baseline groundwater and surface water conditions, primarily water quality and heavy metals contamination, in the vicinity of the proposed sites to be remediated and around the Abu Zabaal Landfill. Groundwater samples were collected according to the USEPA low-flow groundwater sampling procedures (EPA/540/S-95/504). The sampling program was performed under the supervision of the Life-Lead Quality Assurance Manager. Samples collected included the following:

- Eight samples were collected from six wells in the Abu Zaabal area, six samples in addition to a duplicate and a cross reference.
- Three surface water samples were collected from two locations in the Ismailia Canal, two samples in addition to a cross reference.
- Four sediment samples were collected from three locations in the Ismailia Canal, three samples in addition to a duplicate.
- Twenty five samples were collected from twenty one wells in the Shoubra El Kheima area, twenty one samples in addition to two duplicates and two cross-references.
- Additionally, three spikes were sent to the laboratories for quality assurance. Two spikes were sent to the Ain Shams University-Reference Laboratory (ASU-RL) and one spike to Egyptian Mineral Resources Authority (EMRA) Laboratory.

Forty-three samples were sent to the laboratory for analysis, 39 water samples and 4 sediment samples. Locations of water samples are provided in Appendix A, Exhibit 13.

Water Quality Analysis Results--

On-site water quality analyses were performed during the sample collection for all groundwater and surface water samples. The water quality data for the collected surface and groundwater samples are provided in Appendix B, Table 1.

Groundwater Samples at Shoubra El Kheima--

Twenty wells representing the vicinity of the six sites were selected. In addition, a well was selected about one kilometer upstream from the school and smeletrs, in terms of groundwater flow, representing an upstream sample. Nineteen of the 21wells were productive and equipped with water pumping installations. Water was pumped for an identified period of time prior to sample collection to ensure that samples represent the aquifer. The other two were monitoring wells installed during the Cairo Air Improvement Project. Appendix B, Table 2 provides groundwater sampling results from the wells sampled in Shoubra El Kheima.

Groundwater Samples at Abu Zabaal--

Six wells were identified and sampled at the Abu Zabaal Landfill and the surrounding area. Appendix B, Table 3 provides groundwater sampling results at the Abu Zabaal Landfill.

Surface Water Samples from the Ismailia Canal--

Two locations were identified for surface water sample collection. The first location was about 200 meters upstream the Awadallah Smelter No. 2 and the second location was 200 meters downstream from the El Mahy Smelter. Appendix B, Table 4 provides surface water sampling results.

Sediment Samples from the Ismailia Canal--

Three locations were identified for sediment sample collection. The first location was about 200 meters upstream the Awadallah 2 smelter, the second location was in front of the School and Awadallah Smelter No.1, and the third location was 200 meters downstream the El Mahy Smelter. Appendix B, Table 5, provides sediment samples analysis results.

**Water Sampling and Analysis Findings**

The following provides a summary of the groundwater sampling from Shoubra El Kheima:

- pH and nitrate concentrations in all samples were within the permissible limits set in Law 48 and its Executive Regulations.

- Ammonia concentrations in all samples were above the legal limits.

- Lead concentrations in all samples collected were below the legal limits with the exception of the sample collected from the shallow monitoring well (6m) along the Ismailia Canal indicating a concentration of 0.2089 mg/l compared to the legal limit of 0.05 mg/l.

The following provides a summary of the groundwater sampling conducted at Abu Zaabal:

- TDS concentrations in samples collected from the disposal site (Sample AZ101) and the neighbouring residential settlement (Samples 201, 202) were very high (4,078 and 6,336 mg/l, respectively). These wells were installed in rocky areas, limestone in the landfill site and basalt in the neighbouring residential settlement.

- pH, alkalinity, and nitrate concentrations in all samples were within the permissible limits set in Law 48 and its Executive Regulations.

- Ammonia concentrations in all samples were above the legal limits.

- Lead concentrations in all samples were below the legal limits.

The following provides a summary of the surface water sampling from the Ismailia Canal:

- pH, TDS, and nitrate concentrations in all samples were within the permissible limits set in Law 48 and its Executive Regulations.

- Ammonia concentrations in all samples were above the legal limits.

- Increased alkalinity concentration in the downstream sample.

- Lead concentrations in all samples were below the legal limits.

Lead concentrations in the sediment samples from the Ismailia Canal were very low and no legal limits are set for soil contamination.

### 2.4.5 Terrestrial Ecology

The project site is located within the urban landscape matrix of Greater Cairo, parallel to the Ismailia Canal. In general, there are no significant habitats within the project area of influence. Vegetation, an important ecological indicator, is found far from this area. The only and most important ecological feature is the Ismailia Canal that runs as a corridor to the south of the project site. The Ismailia Canal bank near the project site is used as a plant nursery with many different species of plants. Some plant species grow along the bank slope.

The project area, which can be considered as a man made environment, appears to have little ecological significance and low biodiversity due to the immense alteration of the natural ecology. In these areas, only plants and animals that tolerate urban pressures and that can live close to man are found (EEAA, 1993). None of these appear to be of conservational or ecological importance.

### 2.4.6 Aquatic Ecology

The following fish species are recorded in Ismailia Canal around the project site: Oreochromis spp, Tilapia zillii, Anguilla anguilla, Clarias gariepinus, Heterobranchus spp, Lates niloticus and Synodontis clarias. In the vicinity of the project site, only recreational fishing is practiced. Interviews with the local community indicated that the catch is generally low and that no commercial fishing takes place near the site.

### 2.4.7 Solid and/or Hazardous Waste

The project area is contaminated and polluted due to various past and current industrial activities. The five lead smelters included in this study have ceased operation. However, there remains significant lead contamination that will be remediated through project activities. However, there are other sources of pollution in the area that are currently operating such as the cast iron smelters, glass factories, textiles and furniture industries.

Site characterizations were conducted by the project to evaluate the level of lead contamination present at the smelters and the school. The results were used in the preparation of the Baseline Human Health Risk Assessment (BHHRA) and the development of remediation strategies. The site characterizations for the El Shahid Ahmed Shaalan School and the five smelters are summarized below.

### El Shahid Ahmed Shaalan School

Results of the site characterization at the El Shahid Ahmed Shaalan School indicated the following:

- Lead levels exceeded the lower limit of the proposed Risk Based Remediation Guidelines (RBRG) for soil on the school property at five locations on the playground and landscaped areas and in both of the samples taken from the roof of the school buildings.

- During the site characterization, borehole samples were taken up to 1.0 meter below the ground surface, no lead levels exceeding the proposed RBRG for soil on the school property were detected at depths greater than 0.2 meter. This was confirmed by subsurface drilling and soil sampling to depths of up to 5 meters below land surface at 3 soil borings in the school playground. Top of water table was encountered at a depth of 2.02 m in borehole No. 3. Soil stratigraphy of the 3 boreholes is shown in Appendix A, Exhibits 14, 15 and 16. Appendix B, Table 6 provides soil sampling results from the 3 soil borings.

- One of the five samples taken from outside of the school property exceeded the proposed RBRG for lead in soil in residential areas. That sample was taken adjacent to the Ismailia Canal Road.

- Sixty percent of all dust wipe samples collected from inside the school buildings exceeded suggested clean-up levels.

- Two bulk dust samples collected from the floors on the second and third floors of the school building contained lead at levels exceeding the proposed RBRG for lead in dust.

The BHHRA indicated that the non-carcinogenic hazard index (HI) is 2, indicating a potential health hazard may exist. This slightly elevated HI is due to exposure to antimony in soils at the playground. The carcinogenic risk to children at the school is $6 \times 10^{-6}$ indicating that corrective action may be necessary. This cancer risk is due to exposure to lead in soil on the playground. Blood lead modelling results showed that less than 5 percent of the children would have blood lead levels greater than 10 µg/dl. However, lead concentrations in wipe samples collected from inside the school are five times above the suggested clean-up levels.

## Awadallah Smelters

Results of the site characterizations of the three Awadallah Smelters indicated the following:

- Bulk dust and soil samples from inside the property boundaries were only collected at Awadallah Smelters Nos. 1 and 2. Lead levels detected in all but one sample exceeded the lower limit of the proposed RBRG of 1,100 µg/g.

- Dust wipe samples were collected from the floors at all three smelter sites. All of the 33 dust wipe samples collected from floors within the smelter properties showed lead concentrations higher than the lower limit of the suggested clean-up level of 400 $\mu g/ft^2$.

- Dust wipe samples from the walls were only collected at Awadallah Smelter No. 1. All the dust wipe samples collected from walls on the smelter property contained lead levels greater than the lower limit of the suggested clean-up level of 400 $\mu g/ft^2$.

- Surface soil samples from twelve of the thirteen locations in the streets and on the Ismailia Canal bank adjacent to the smelter sites contained lead that exceeded the proposed RBRG for residential areas of 400 µg/g.

- All but one of the sieved soil samples from these sites had higher lead levels than the unsieved samples from the same sites.

- All of the sieved soil samples exceeded the proposed RBRG.

For Awadallah Smelters Nos. 1 and 2, the BHHRA indicated that the non-carcinogenic HI for workers at the former smelter is less than 1 indicating that a non-carcinogenic health hazard is not expected. The carcinogenic risk to workers at both smelters is $9 \times 10^{-5}$ indicating that corrective action may be necessary. This cancer risk is due to exposure to lead and arsenic in soils and dust. Blood lead modelling showed that 94 percent of the workers at Awadallah Smelter No. 1 and 98 percent of the workers at Awadallah Smelter No. 2 are expected to have blood lead levels greater than 10 µg/dl. Based on the blood lead modeling results corrective action is necessary.

BHHRA was not performed for Awadallah Smelter No. 3 since the site was cleaned and no soil or dust samples were available for collection. The remediation activities conducted by the owner at this site are the same as the other two Awadallah Smelter sites. Therefore, it is reasonable to assume that the risk is similar.

## Seoudi Smelter

Results of the site characterization for the Seoudi Smelter indicated the following:

- Lead levels detected in all of the surface soil samples collected on the smelter property exceeded the lower limit of the proposed RBRG of 1,100 µg/g.

- Lead levels detected in both of the borehole samples exceeded the proposed RBRG to a depth of 0.5 meters, and in the borehole near where the furnace outlet the lead levels exceeded the proposed RBRG to a depth of 3.5 meters. Top of water table was encountered at a depth of 4.5 m in borehole No. 1. Soil stratigraphy of the 2 boreholes is shown in Appendix A, Exhibits 17 and 18. Appendix B, Table 7 provides soil sampling results from the 2 soil borings.

- All the dust wipe samples collected from the smelter property contained lead levels greater than the suggested clean-up level of 400 µg/ft$^2$.

- Four of five surface soil samples collected in the streets and on the Ismailia Canal bank adjacent to the site contained lead that exceeded the proposed RBRG for residential areas of 400 µg/g.

The BHHRA indicated that the non-carcinogenic HI for workers at the Seoudi Smelter is 40 and the carcinogenic risk to workers at this smelter is $7 \times 10^{-4}$. These health risks are due to lead, antimony, and arsenic. Blood lead modeling showed that 100 percent of the workers are expected to have blood lead levels greater than 10 µg/dl. These risk estimates indicate that corrective action is necessary.

### El Mahy Smelter

Results of the site characterization at the El Mahy Smelter indicated the following:

- Lead levels detected in all of the surface soil samples collected on the smelter property exceeded the lower limit of the proposed RBRG of 1,100 µg/g.

- Lead levels detected in the borehole samples exceeded the proposed site specific RBRG of 1,100 µg/g at several depths. Lead levels generally decreased with depth, and dropped below the lower limit of the proposed RBRG in the boreholes at depths ranging between 1.5 to 3 meters. Top of water table was encountered at depths of 4.5, 4.7 and 4 m in boreholes No. 1, 2 and 5 respectively. Soil stratigraphy of the 5 boreholes is shown in Appendix A, Exhibits 19-23. Appendix B, Table 8 provides soil sampling results of the 5 soil borings.

- All of the dust wipe samples collected from the interior of the perimeter walls, the insides of buildings structures, and equipment on the smelter property contained lead levels greater than the suggested clean-up level of 400 µg/ft$^2$.

- All six of the surface soil samples collected in the areas surrounding the smelter had lead levels above the proposed RBRG for residential areas of 400 µg/g.

The BHHRA indicated that the non-carcinogenic HI for workers at the El Mahy Smelter is 96 and the carcinogenic risk to workers at this smelter is $6 \times 10^{-4}$. These health risks are due to lead, antimony, arsenic, and cadmium. Blood lead modelling showed that 100 percent of the workers are expected to have blood lead levels greater than 10 µg/dl. These risk estimates indicate that corrective action is necessary.

### 2.4.8 Disposal Sites

Two disposal sites are available to be used by the project as indicated in the following:

- The Abu Zaabal Landfill located about 25 km northeast of Shoubra El Kheima will be used for the disposal of non-hazardous and/or decontaminated waste and soil generated from remediation activities.

- The El Nasreya Hazardous Waste Landfill located in Borg EL Arab, Governorate of Alexandria, Egypt will be used for the disposal of hazardous waste and soil generated from remediation activities.

## 2.5 Aesthetic and Cultural Conditions

The project area is presently a mixed industrial and residential area. There are no aesthetic or cultural elements or resources of importance in the area.

## 2.6 Future Conditions Without the Project

Ceasing operation of the furnaces at the smelters was a major step in reducing the amount of lead emitted to the environment. However, this has only eliminated a portion of the smelters' impacts on the surrounding community. Because lead does not dissipate, biodegrade, or decay, the lead deposited at the smelter site and in the surrounding community remains a source of lead exposure even after smelter closure.

Chronic exposure to lead contamination may cause a wide variety of adverse health effects, ranging from reduction in the intelligence quotient of children to kidney cancer. Lead emissions are of particular concern for women of childbearing age and children under seven years of age. Children and young adults in areas that have been contaminated by smelter emissions can be exposed to lead through inhaling or ingesting dust and soil. Fugitive dust from the smelter and the surrounding area can be blown and deposited on uncovered food and water and subsequently ingested.

Without the project, the polluted media (soil, waste piles, and structures) will act as potential sources of lead contamination causing further deterioration of the environmental quality of the area as well as the health quality of the residents and workers of Shoubra El Kheima.

# 3. ENVIRONMENTAL IMPACTS

This EA focuses on the remediation activities that will take place in the five smelter sites (Awadallah Smelters Nos. 1, 2, and 3, and the El Mahy and Seoudi Smelters) and the El Shahid Ahmed Shalaan School. The assessment covers the proposed on-site clean-up/remediation activities (e.g., soil excavation) as well as the transportation of the generated waste to the waste disposal sites. The scope of the EA does not include assessment of final waste disposal activities since the contaminated waste will be disposed in a licensed hazardous waste landfill and the non-contaminated waste will be disposed in a licensed solid waste landfill. These landfills are designed and managed according to the type of waste that they are licensed to receive.

The EA also involved a public scoping process, where concerned stakeholders were consulted at the scoping stage of the EA process to identify their concerns pertaining to project implementation. All issues and concerns, relevant to the remediation activities, raised during public consultation were considered in the EA.

The methodology used for identification and assessment of the potential impacts associated with project activities is described in Appendix D. A summary of Scoping Report and other public consultation meetings is provided in Appendix E.

## 3.1 Land Use and Regional Planning Impacts

### 3.1.1 Land Use

**Short Term Impact**

There will be no effect on the land use of the smelter sites during remediation/clean-up activities since operation has already ceased in these sites. However, the school cannot continue its operation during clean-up activities. Therefore, the school clean-up activities will be carried out during the summer vacation, so as not to impact current facility use.

**Long Term Impact**

There will be no change in the school land use after cleanup activities. The land use at the lead smelters that are being remediated by this project will be permanently restricted to industrial and commercial uses that will not breach the integrity of the method of remediation used. The remediated smelter sites will have restricted uses including their use as garages, warehouses, or show rooms.

### 3.1.2 Regional Planning

**Long Term Impact**

There is no conflict between the remediation project and the existing regional plans for the area. The GOQ is planning on relocating polluting industries existing in Shoubra El Khiema to the Abu Zaabal Industrial Area with the intention of improving the environmental and health quality of the area. Life-Lead will contribute to improving the environmental quality of the area and allowing for the reuse of the remediated sites for their intended use as garages, warehouses, or show rooms.

## 3.2 Socio-Economic Impacts

### 3.2.1 Demographic and Migration Impacts

Impacts on demography and migration are expected to be negligible.

### 3.2.2 Economic and Employment

**Short Term Positive Impacts**

Remediation of school and the smelter sites will lead to new employment opportunities for the local community during the period of site remediation. Wages will be paid to local labor as the remediation activities are implemented. For example, the school remediation is estimated to generate approximately 1,000 man-days of work for skilled laborers.

**Long Term Positive Impacts**

This is one of the first site remediation projects in Egypt and it is anticipated to initiate new hazardous waste site remediation businesses. A cadre of specialized construction contractors and workers have been trained as part of the project to remediate lead and other contaminated sites. There have been seven companies qualified by the project to bid on the remediation projects. These companies will also be listed in a register at the EEAA that will allow companies needing remediation contractors in the future to identify those that have been trained in both health and safety and remediation procedures.

It is anticipated the property values in the vicinity of the smelters will appreciate due to the improvement of the health and environmental quality in the area. The property in the area is changing from industrial to residential causing property values to increase significantly. The remediation of these sites will lead to increased property value throughout the area.

### 3.2.3 Quality of Life

**Long Term Positive Impacts**

The remediation of school and smelter sites will lead to the elimination of lead health exposure pathways. This will lead to improvements in the health of the students, school workers, and teachers as well as improve the overall public health of the lead smelter areas through the removal/treatment of the persistent source of lead contamination.

**Negligible Impacts**

All remediation activities carried out within the smelter/school buildings will be contained within decontamination zones and areas of exclusion. Therefore, emissions will not reach the neighboring communities and there will be negligible impact on the public health and safety.

**Short Term Direct/Indirect Avoidable Negative Impacts**

The remediation activities could have short-term negative effects in the community. However, this is an industrial area where the residents live with noise and dust that may not occur in other residential areas. Methods will be employed including dust control and requiring muffling on all equipment used in the remediation process to minimize these impacts.

**Short Term Direct Avoidable Negative Impacts**

Workers health and safety could be affected during the remediation project through the following:

- Inhalation of lead contaminated dust during facility remediation.
- Inhalation of lead contaminated dust caused by the soil excavation process.

- Direct contact with contaminated soil, waste piles, or contaminated walls, floors, and ceilings.
- Inhalation of exhaust gases caused by transportation activities or equipment.
- Accidents.
- Spill of solvents or other harmful materials.

### 3.2.4 Transportation, Telecommunication, and Utilities

**Short Term Direct Avoidable Negative Impacts**

Heavy traffic during remediation activities will be experienced in the area around the smelters/school and at the intersection with the main road parallel to the Ismailia Canal during transportation to the disposal site. This could result in traffic congestion and increase the probability of accidents. However, because the duration of remediation activities at each site will be relatively short and the Ismailia Canal Road is already a busy road since it is an industrial area, the overall impact on traffic in the area should be minimal.

Water, wastewater, gas pipelines, and electricity cables would not be affected by remediation activities except if soil excavation is deep enough to reach their level. The area utility layouts would be used to locate utilities in the areas where soil will be excavated and to avoid impacts. The contractors selected to perform the remediation will be responsible for working with the GOQ to identify and verify the location of underground utilities.

### 3.2.5 Education, Health, and Social Service Impacts

**Long Term Positive Impact**

Remediation of the El Shahid Ahmed Shaalan School will encourage its administration to increase enrollment in the school.

## 3.3 Physical Environment

### 3.3.1 Climate

The project has no effect on the climate.

### 3.3.2 Geology, Hydrogeology, and Soil Quality

**Long Term Positive Impacts**

Remediation of existing polluted sites will lead to long-term improvement in the soil and groundwater quality within the remediated sites and in the neighborhood due to the removal, containment, and/or treatment of the contaminated soil.

**No Direct Impacts**

The project has no significant geological and hydrogeological features in the project area. There will be no direct contact between the remediation and clean-up activities carried out within the smelters/school buildings and the groundwater. Therefore there will be no direct impact from these activities on the groundwater.

**Short Term Direct Avoidable Negative Impacts**

The impact on soil quality from clean-up and decontamination activities of the smelters/ school buildings can only occur if contaminated dust emissions or debris are allowed to deposit on the soil or through spills or leakage of contaminated wastewater (from washing activities) or fuel to the soil.

The impacts on the soil within the smelter/school boundaries from soil removal or stabilization and then capping or replacement will have a positive, rather than a negative impact, on the soil quality that was treated. However, dust resulting from excavation and hauling of soil may have negative impacts on the soil quality if dust control measures are not put into place to contain air borne emissions.

The soil quality along the transportation routes to the disposal sites could be negatively impacted if the transported material or waste are not properly contained. Containers used for the transportation of waste materials to the disposal sites will be water tight and must be properly covered to contain any air borne emissions.

**Short Term Indirect Avoidable Negative Impacts**

Groundwater quality could be negatively impacted if soil excavation reaches the groundwater level and the contaminated soil comes into direct contact with the groundwater. In addition, spillage of the contaminated wastewater may cause groundwater pollution. Methods are being put in place to control these impacts and it is not anticipated that remediation activities will come into contact with groundwater at the school or the smelters.

### 3.3.3 Air Quality and Noise

**Long Term Positive Impacts**

Remediation of existing polluted sites will lead to improvement in the air quality of the area due to the removal, containment, and/or treatment of the contaminated lead dust.

**Short Term Direct Avoidable Negative Impacts**

The ambient air quality at the project site may be impacted by gaseous emissions and fugitive dusts from remediation activities. The main sources of emissions at the remediation sites include the following:

- Decontamination activities.
- Vacuum cleaning.
- Removal of old paint and plaster.
- Soil excavation and backfill operations.
- Wind erosion of exposed waste material or soil.
- Construction equipment and machinery.

Transportation of raw material, labor, and equipment to the smelter/school sites and transportation of the contaminated waste from the sites to its final disposal site will have impacts on the air quality and noise levels along the transportation route.

**Short Term Direct Avoidable Negative Impacts**

During the implementation of the remediation activity, noise will occur from the excavation/ scraping equipment used for soil excavation. Also the equipment used for dry and wet building cleaning are another source of noise. The use of earth moving and compaction equipment may generate localized noise pollution. Table 3.1 shows the average noise level, in decibels, at a distance of 20 m between an observer and the source of noise.

**Table 3.1 Average Noise Levels from Construction Equipment (in decibels) at a Distance of 20 m between Observer and Machinery**

| Equipment Type | Average Noise Level (decibels) at 20 m |
|---|---|
| Loader | 78 |
| Vibration Roller | 74 |
| Sprayer | 75 |
| Generator | 86 |
| Impact Drill | 75 |
| Concreter Mixer | 79 |
| Pneumatic Hammer | 86 |

The remediation activity will result in an increase in the traffic load, especially heavy traffic such as buses and trucks used for the transportation of workers and material to and from the site, and transportation of waste to the disposal sites. This will lead to increased neighbour-hood noise levels.

### 3.3.4 Water Supply and Quality

**Long Term Positive Impacts**

Remediation of existing polluted sites will lead to long-term improvement in the surface water quality due to the treatment and/or removal of the contaminated soil.

**Short Term Direct/ Indirect Avoidable Negative Impacts**

The water quality of surface water bodies such as the Ismailia Canal may be negatively impacted during transportation of raw material to the smelter/school sites and especially during transportation of contaminated waste or soil from the project sites to the disposal site. This could be as a result of the deposition of wind blown dust on the surface water or direct spills into the canal in case of traffic accidents.

### 3.3.5 Terrestrial Ecology

**No Direct Impacts**

The smelters and school lie within an industrial area that is devoid of sensitive terrestrial fauna and flora expect for some common trees and plants that already have lead dust deposited on their leaves. Remediation activities will therefore have no direct impacts on terrestrial life.

### 3.3.6 Aquatic Ecology

**No Direct Impacts**

All remediation activities that will be carried out within the smelter/school boundaries will be contained within the site and thus there will be no direct impact on the Ismailia Canal or its aquatic life.

**Short Term Indirect Avoidable Negative Impacts**

Aquatic life of the Ismailia Canal may be negatively impacted during transportation of raw material to the smelter/school site and especially during transportation of contaminated waste or soil from the sites to the disposal site. This could be as a result of the deposition of wind blown dust on the surface water or direct spills into the canal in case of traffic accidents.

### 3.3.7 Solid and/or Hazardous Wastes

Non-hazardous solid waste arising from remediation activities will include the following:

- Demolition waste of decontaminated walls, paint, and plaster.
- Dismantled decontaminated equipment.
- Wastes resulting from cement and asphalt concreting.
- Stabilized soil.
- Packing and packaging material.

Hazardous waste resulting from remediation activities will include the following :

- Excavated contaminated soil.
- Contaminated debris.
- Cleaning mops and materials.

If the above-mentioned solid and hazardous waste are not properly stored and handled on site before they are transported to the final disposal site, they could affect the environmental attributes of the physical and socio-economic environment as previously mentioned.

The contaminated wash water resulting from decontamination activities in the smelters will be allowed to seep into the already contaminated soil or will be used as dust control on soil being transported to the hazardous waste disposal site. Allowing the wash water to be placed on contaminated soil is a viable alternative as lead will not penetrate the near surface and the soil will be removed or stabilized on site.

### 3.3.8 Disposal Sites

Contractors will be responsible for transportation of waste generated from the remediation actions. Hazardous waste will be disposed at the El Nasreya Hazardous Waste Landfill in

Alexandria, Egypt and the non-hazardous waste will be disposed in the Abu Zaabal Landfill. Both landfills are designed and managed in a manner suitable for the type of waste they are allowed to accept.

## 3.4 Aesthetic and Cultural Conditions

There are no aesthetic or cultural issues of concern in the project area.

## 3.5 Assessment of Overall Impacts

### 3.5.1 Short and Long Term Impacts on Resources and Environmental Productivity

Minimal short term impacts on the population and environment are to be expected due to the remediation activities. These impacts could be caused by dust, noise, worker health and safety, waste handling, and waste transportation. Minor increases in dust and noise can be expected. Traffic along the Ismailia Canal Road and on the routes to the Abu Zabaal and El-Nasreya Landfills would be affected, but these routes are the only access to the landfills.

Air quality in Shoubra El Kheima will be improved as a result of the removal of contaminated lead dust. Soil, surface water, and groundwater quality within the area will improve as a result of the remediation activates. Workplace health and safety for the workers at the remediated sites will be greatly enhanced due to the remediation activities.

### 3.5.2 Cross-sectoral Impacts and Effects on Other Projects

The project will have a positive long term impact on the future uses of the sites. The project is also consistent with the industry relocation plan that is being implemented by the Government of Egypt for the Shoubra El Kheima area. The industries in the area of the project will be relocating to the new Abu Zabaal Industrial Area.

### 3.5.3 Cumulative and Irreversible Impacts

The cumulative effect will be improved public health and safety due to improved ambient air quality and the reduction of lead as a potential source of surface water and groundwater contamination.

It could be concluded that the following receptors could be impacted by the project's remediation activities.

- Ambient air quality.
- Ambient noise levels.
- Soil and groundwater quality.
- Surface water quality and marine life.
- Public health and safety.
- Workplace health and safety.

Impact on the above receptors could be prevented and reduced through implementation of mitigation measures and through proper management and monitoring as discussed in Section 5.

# 4. COMPARISON OF ALTERNATIVES AND RECOMMENDATIONS

## 4.1 No- Action Alternative (Alternative 1)

This alternative is not recommended for any site. If remediation activities are not carried out, then the existing lead pollution hazards will persist causing further deterioration of the environmental quality of the area. No-action will also impact the health of students in the school, workers in the closed smelter facilities, and the residents of Shoubra El Kheima.

## 4.2 Comparison of Alternatives

The proposed alternatives for each site were chosen among four potential alternatives that were identified during the remediation design process. The recommended alternative was selected in consultation with EEAA, Hai Shark and Education Directorate of Shoubra El Kheima, smelter owners and USAID as being the best alternative that could be accomplished within available funding.

The detailed design is underway for the El Shahid Ahmed Shalaan School. The design alternatives for the school and smelter sites may be slightly modified prior to implementation. This could be particularly the case when comparing the use of different capping (soft or hard) for the playground at the school. It could also be the case when deciding whether to use stabilized soil or structural backfill to fill excavations at the smelter sites. The final decision will likely depend on the restrictions imposed during detailed design for the school and the smelter sites.

As such, table 4.1 provides an evaluation of potential impacts associated with the proposed remediation activities. The short and long term impacts of the alternatives for each of the facilities to be remediated is provided. Feasible alternatives are the ones selected for implementation.

## 4.3 Recommendations

From an environmental standpoint, Alternatives 3 and 4 are equally recommended for all sites. The choice of the proposed alternative depends on other factors which include effectiveness, implementability, and cost. The cost factor provides a decisive criterion for choosing among different alternatives. The objective of the financial analysis is to estimate the present value of expected cost of the four alternatives under investigation, in order to propose the alternative with the most cost effectiveness.

The proposed alternatives with appropriate mitigation and monitoring measures should be implemented.

For the purpose of preparing this EA, and prior to the beginning of remediation, baseline environmental conditions were defined for monitoring during the remediation activities. Baseline conditions were established for air quality, noise, soil, surface water, and groundwater as has been described in Section 2. The baseline conditions will be used to monitor the remediation activities impact to the environment and to insure that mitigation measures are implemented and functioning properly.

## Table 4.1: Comparison of Alternatives for Project Sites

| | Short Term Impacts | Long Term Impacts/Benefits |
|---|---|---|
| **El Shahid Ahmed Shaalan School** | | |
| **Alternative 2: Interior School Cleaning and Site Management** | Temporary negative impacts on air quality, ambient noise, workplace health and safety as well as traffic.<br><br>No direct impact on soil quality, groundwater and surface water quality, biological life and public health and safety. | This alternative will result in the remediation of the school buildings and its interior surfaces, and will limit airborne pollutants from entering the building through the replacement of broken doors and windows.<br><br>However, since no soil remediation actions will be carried out in the playground, a major source of pollution will still persist, which is the contaminated soil. Dust from this soil could become air borne and deposit of the surfaces of the school buildings, which will regenerate the health problems presently encountered. The students will still be exposed to the contaminated soil in the playground which will lead to the inhalation, ingestion, or dermal intake of the contaminant.<br><br>This alternative is considered a partial solution to the problem and is therefore not recommended. |
| **Alternative 3: Interior School Cleaning/Coating, Limited Soil Removal/Soil Covering and Site Management** | This will result in incremental short-term environmental impacts to the impacts already encountered in Alternative 2 due to the environmental aspects resulting from the following extra activities:<br>• Excavation, hauling and loading of contaminated soil.<br>• Backfilling with clean soil.<br>• Covering with compacted soil<br>• Transportation of waste soil.<br>Environmental concerns associated with these activities include increased dust and fugitive emissions, noise, traffic, transportation accidents, and spills. | This alternative will result in the remediation of the school buildings and its interior surfaces as well as the playground through removal of the contaminated soil from identified "hot-spots". The covring must be replaced annually.<br><br>This alternative will result in long-term environmental benefits to the environmental quality of the area and the health of the public, school students, and workers.<br><br>From an environmental standpoint, this alternative is recommended. |

**Table 4.1: Comparison of Alternatives for Project Sites (cont.)**

| | Short Term Impacts | Long Term Impacts/ Benefits |
|---|---|---|
| **El Shahid Ahmed Shaalan School** | | |
| **Alternative 4: Interior School Cleaning/Coating, Soil Capping, Landscape and Site Management** | This will result in incremental short-term environmental impacts in addition to those encountered in Alternative 2 due to the environmental concerns resulting from the following additional activities:<br>• Excavation, hauling and loading of contaminated soil.<br>• Backfilling with clean soil.<br>• Placement of concrete cap.<br>• Transportation of waste soil.<br>Environmental concerns associated with these activities include increased dust and fugitive emissions, noise, traffic, transportation accidents, and spills. | This alternative will result in the remediation of the school buildings and its interior surfaces as well as the playground through removal of the contaminated soil from identified "hot-spots". The hard capping has an expected life of 20 years.<br><br>This alternative will result in long-term environmental benefits to the environmental quality of the area and the health of the public, school students, and workers.<br><br>From an environmental standpoint, this alternative is recommended. |
| **Awadallah Smelters** | | |
| **Alternative 2: Institutional/Engineering Controls, Decontamination of Structures** | Temporary negative impacts on air quality, ambient noise, workplace health and safety as well as traffic.<br><br>No direct impact on soil quality, groundwater and surface water quality, biological life, and public health and safety. | This alternative will result in the remediation of the three Awadallah Smelters. However, since no remediation actions will be carried out to the soil, a major source of pollution will still persist which is the contaminated soil. Dust from this soil could become air borne and deposit of the surfaces of the smelters structures which will regenerate the health problems presently encountered by users of the smelters. Primary lead exposure route at Awadallah is by contact/ingestion of dust[MSOffice4].<br><br>This alternative is considered a partial solution to the problem and is not recommended. |

**Table 4.1: Comparison of Alternatives for Project Sites (cont.)**

| | Short Term Impacts | Long Term Impacts/ Benefits |
|---|---|---|
| | **Awadallah Smelters** | |
| **Alternative 3 Institutional/Engineering Controls, Decontamination of Structures, Excavate/ Dispose Limited Soil Offsite, Cover Traffic Areas** | This will result in incremental short-term environmental impacts to the impacts already described in Alternative 2 due to the environmental concerns resulting from the following additional activities:<br>• Excavation, hauling and loading of contaminated soil.<br>• Placement of cover (gravel or CMB).<br>• Transportation of waste soil.<br>Environmental concerns associated with these activities include increased dust and fugitive emissions, noise, traffic, transportation accidents, and spills. | This alternative will result in long-term environmental benefits to the environmental quality of the area and public and smelter workers health due to the remediation of the two major contaminated media; surfaces of existing structures and soil.<br><br>From an environmental standpoint, this alternative is recommended. |
| **Alternative 4 Institutional/Engineering Controls, Decontamination of Structures, Excavate/ Dispose limited Soil Offsite, Cap Traffic Areas** | This alternative will result in incremental short-term environmental impacts to the impacts already encountered in Alternative 2 due to the environmental concerns resulting from the following extra activities:<br>• Excavation, hauling and loading of contaminated soil<br>• Placement of hard cap (asphalt concrete with gravel or CMB bedding)<br>• Transportation of waste soil<br>Environmental concerns associated with these activities include increased dust and fugitive emissions, noise, traffic, transportation accidents, and spills. | This alternative will result in long-term environmental benefits to the environmental quality of the area and the health of the public and smelter workers due to the remediation of the two major contaminated media; surfaces of structures and soil. The provision of asphalt concrete cap will provide extra protection and sealing for the soil.[MSOffice5]<br><br>From an environmental standpoint, this alternative is recommended. |

**Table 4.1: Comparison of Alternatives for Project Sites (cont.)**

| | Short Term Impacts | Long Term Impacts/ Benefits |
|---|---|---|
| **Seoudi Smelter** | | |
| **Alternative 2: Institutional/Engineering Controls, Decontaminate Structures and Debris, Limited Soil Removal/ Cap** | Temporary negative impacts on air quality, ambient noise, workplace health and safety as well as traffic. In addition, contamination on walls will be transferred to the soil since the contaminated wash water will be allowed to seep to the soil.<br><br>No direct impact on surface water quality, biological life. | This alternative will lead to long-term benefits to the environmental quality of the smelter area, and public and workers health as long as concrete capping of the soil is maintained. However, if the cover is eroded or broken, the contaminated soil may be exposed. Migration pathways through the cap may result in further de-stabilization of contaminated soil.[MSOffice6]<br><br>This alternative is considered a partial solution to the problem and is therefore not recommended |
| **Alternative 3: Institutional/Engineering Controls, Decontaminate Structures and Debris, Excavate/Dispose Offsite as Hazardous Waste/ Cap** | This alternative will result in incremental short-term environmental impacts in addition to the impacts encountered in Alternative 2 due to the environmental concerns resulting from the following additional activities:<br>• Deep excavation, hauling and loading of contaminated soil.<br>• Placement of hard cap.<br>• Transportation of waste soil.<br><br>Environmental concerns associated with these activities include increased dust and fugitive emissions, noise, traffic, transportation accidents, and spills. | This alternative will result in long-term environmental benefits to the environmental quality of the area and the health of the public and smelter workers due to the remediation of the two major contaminated media; surfaces of existing structures and soil.<br><br>From an environmental standpoint, this alternative is recommended |

**Table 4.1: Comparison of Alternatives for Project Sites (cont.)**

| | Short Term Impacts | Long Term Impacts/ Benefits |
|---|---|---|
| **Seoudi Smelter** | | |
| **Alternative 4: Institutional/Engineering Controls, Decontaminate Structures and Debris, Excavate/Stabilize/Dispose Offsite as Non-Hazardous Waste/Cap** | This alternative will result in incremental short-term environmental impacts to the impacts already described in Alternative 2 due to the environmental concerns resulting from the following additional activities:<br>• Deep excavation and stabilization of soil.<br>• Backfilling with stabilized soil and/or structure backfill.<br>• Hauling and loading of extra uncontaminated soil.<br>• Placement of hard cap.<br>• Transportation of waste soil.<br><br>Environmental concerns associated with these activities include increased dust and fugitive emissions, noise, traffic, transportation accidents, and spills. However, a smaller volume of contaminated material will be transported to the El Nasereya Landfill. This will decrease impacts associated with handling and transportation of contaminated soil. | This alternative will result in long-term environmental benefits to the environmental quality of the area and the health of the public and smelter workers due to the remediation of the two major contaminated media; surfaces of existing structures and soil<br><br>From an environmental standpoint, this alternative is recommended |
| **El Mahy Smelter** | | |
| **Alternative 2: Institutional/Engineering Controls, Decontaminate Structures, Equipment, Piles /Remove Equipment** | Temporary negative impacts on air quality, ambient noise, workplace health, and safety as well as traffic. Contamination on walls will be transferred to soil since the contaminated wash water will be allowed to seep to the soil.<br>No direct impact on surface water quality or biological life. | This alternative will lead to long-term benefits to the environmental quality of the smelter area and public and workers health. It does not include soil remediation. This alternative is considered a partial solution to the problem and is therefore not recommended. |

**Table 4.1: Comparison of Alternatives for Project Sites (cont.)**

<table>
<tr><th></th><th>Short Term Impacts</th><th>Long Term Impacts/ Benefits</th></tr>
<tr><td colspan="3">El Mahy Smelter</td></tr>
<tr><td>Alternative 3: Institutional/Engineering Controls, Decontaminate Structures, Equipment, Piles/Remove Equipment, Excavate/Dispose Offsite as Hazardous Waste/Cap</td><td>This alternative will result in incremental short-term environmental impacts to the impacts already encountered in Alternative 2 due to the environmental concerns resulting from the following additional activities:<br>• Excavation, hauling and loading of contaminated soil.<br>• Placement of hard cap.<br>• Transportation of waste soil.<br>Environmental concerns associated with these activities include increased dust and fugitive emissions, noise, traffic, transportation accidents, and spills.</td><td>This alternative will result in long-term environmental benefits to the environmental quality of the area and the health of the public and smelter workers due to the remediation of the two major contaminated media; surfaces of existing structures and soil.<br><br>From an environmental standpoint, this alternative is recommended</td></tr>
<tr><td>Alternative 4: Institutional/Engineering Controls, Decontaminate Structures, Equipment, Piles/Remove Equipment, Excavate/Stabilize/Dispose Offsite as Non-Hazardous Waste/ Cap</td><td>This alternative will result in incremental short-term environmental impacts to the impacts already encountered in Alternative 2 due to the environmental concerns resulting from the following additional activities:<br>• Excavation and stabilization of soil.<br>• Backfilling with stabilized soil and/or structure backfill.<br>• Hauling and loading of extra uncontaminated soil.<br>• Placement of hard cap.<br>• Transportation of waste soil.<br>Environmental concerns associated with these activities include increased dust and fugitive emissions, noise, traffic, transportation accidents, and spills. However, a smaller volume of contaminated material will reach the El Naserya Hazardous Waste Landfill. This will decrease the impacts associated with handling and transportation of contaminated soil.</td><td>This alternative will result in long-term environmental benefits to the environmental quality of the area and the health of the public and smelter workers due to the remediation of the two major contaminated media; surfaces of existing structures and soil<br><br>From an environmental standpoint, this alternative is recommended</td></tr>
</table>

# 5. MANAGEMENT, MITIGATION AND MONITORING

The project's Environmental Management Plan (EMP) consists of a set of mitigation, monitoring and institutional measures to be taken into consideration during and after the implementation phase. The EMP's intent is to eliminate adverse environmental and social impacts and prevent or reduce them to acceptable levels. In addition, the EMP includes the actions needed to implement these measures.

The EMP measures and reports environmental performance as part of a continuous improvement process; creating a climate of transparency and strategic partnerships with key stakeholders and develops effective training in order to raise public environmental awareness.

The EMP will be regularly updated by the project team to reflect the ongoing activities at the site. For each of the project activities, the EMP will list the requirements to ensure effective mitigation of each relevant potential impact.

## 5.1 Mitigation and Monitoring of Physical Impacts

### 5.1.1 Air Quality

#### Mitigation

To contain dust generation during remediation and clean-up activities, decontamination areas will be established to isolate the activities and prevent lead contaminated dust from being emitted to the atmosphere. The decontamination areas will be equipped with centralized dust collection systems to capture, transport, and separate dust emitted from the processing and materials handling areas through reverse pulse dust filters. Collected dust will be properly handled and stored in closed containers until it is transported with the waste soil to the appropriate disposal site.

As for dust generated during excavation and soil loading and transportation, windscreens (plastic sheets) and water spraying will be used to suppress dust as needed.

Life-Lead will monitor the contractor's implementation of mitigation measures throughout the project. The mitigation measures will include dust suppression measures at the site by watering of haulage roads, and maintaining machinery and vehicles in good working condition to minimize fugitive emissions. All equipment will be frequently inspected and maintained to ensure no fugitive emissions are generated, such as volatile hydrocarbon or nitrogen oxides.

#### Monitoring

Parameters that will be monitored include:

- Dust, including total suspended particles and inhalable particulate matter (PM10).
- Lead concentrations.

### 5.1.2 Noise

#### Mitigation

When construction equipment is used, such as during the site excavation, earth moving, and land grading, workers at distances less than 5 m from the construction equipment must wear ear protective equipment to minimize possible impacts from noise.

Equipment and transportation vehicles are periodically maintained to minimize noise levels to design limits. Monitoring will ensure that the noise levels are kept below legal limits set forth in Law 4/1994.

**Monitoring**

Operational noise will be monitored during the remediation phase. The measurements will take place at the same points identified during the baseline information collection phase (Section 2.4.3).

### 5.1.3 Soil and Groundwater Quality

**Mitigation**

Soil excavation and stabilization activities will go as deep as 4 meters depending on the site. Excavation will be well above the groundwater level. Therefore, there will be no impact on the groundwater from soil excavation activities.

All liquid and solid waste as well as fuel and chemicals used, during site remediation will be properly stored above ground and contained to avoid spills and leaks to the soil. The storage tanks will be frequently inspected for leaks and damage.

**Monitoring**

Groundwater samples will be collected from the same representative industrial wells used to collect the baseline groundwater quality data. Samples will be taken prior to the beginning of the smelter remediation, and following the completion of all remediation activities.

### 5.1.4 Surface Water Quality and Marine Life

**Mitigation**

The risk of polluting surface water bodies (i.e., Ismailia Canal) and affecting its marine life could be mitigated through the following:

- Provision of proper containment and cover for transported waste to prevent dust from becoming wind blown and depositing on the neighboring water body.

- Planning and emergency response measures provided in Section 5.6 to minimize risk of accidental spills.

**Monitoring**

Surface water and sediment samples will be collected from different locations along the Ismailia Canal. The measurements will take place at the same points identified during the collection of baseline data. Sediment samples will be taken from the canal prior to construction activities at the smelter sites and following the completion of all remediation activities. Surface water samples will be taken following the completion of the remediation activities.

## 5.2 Mitigation and Monitoring of Socio-Economic Impacts

### 5.2.1 Public Health and Safety

Impacts on the neighboring communities public health will be mitigated through the provision of air pollution controls as previously mentioned . Establishment of decontamination areas during remediation activities as well as using dust suppression measures such as water spraying will greatly reduce the impact on neighboring communities.

In addition, the proper training of drivers on defensive driving and frequent inspection of the haul trucks will greatly reduce the risk of accidents.

### 5.2.2 Workers Health and Safety

The Life-Lead Site Engineer will have a continuous presence on-site for close inspection and management of the construction activities. The contractors will apply a number of control measures including the following:

- Contractor's employees involved in any facility remediation of lead contaminated sites must have received Health and Safety Training in the form provided by LIFE-Lead to the pre-qualified contractors. The Contractors must verify that the nominated Project Manager has provided Health and Safety of Hazardous Waste Operations Training to employees working on the project. The Contractor must, at a minimum, provide all required personnel protection equipment, personnel decontamination stations, personnel medical monitoring, air monitoring, and required record keeping.

- The General Health and Safety Plan will be required as part of the bid submittal whereas the Site Specific Heath Safety Plans will be required after Notice of Award.

- The contractor will provide documentation and results that all medical monitoring has been conducted prior, during, and after the project; and provide records of air monitoring results.

- Engineering control (e.g., design of the decontamination areas in which workers will operate to ensure proper ventilation and dust collection).

- Personal protective equipment (PPE) will be used by the workers at all times.

- Flammable material will be stored in an isolated, shaded, and labelled area. Fire extinguishers will be installed in designated places at the site and will be regularly inspected.

An Emergency Response Plan was developed to mitigate the occupational health and safety hazards of the workplace, as presented in Section 5.6 below.

### 5.2.3 Transportation Risks

This category includes transportation of contaminated soil (hazardous waste) to Nasereya landfill, and transportation of contaminated materials and cleaning residues (non-hazardous waste) to Abu Zabaal landfill. Contractors will be responsible for transportation of waste generated from the remediation actions. Risks of vehicle accidents from the hauling of excavated soil and waste from the remediation sites to the disposal facilities are included in the Emergency Response Plan. The vehicular risks are addressed by measures such as proper training of drivers on defensive driving and by regular inspection and maintenance of the haul trucks.

## 5.3 Mitigation and Monitoring of Cultural Impacts

The are no areas of cultural significance associated with the remediation activities. Therefore, no mitigation or monitoring is required.

## 5.4 Mitigation and Monitoring of Cumulative Impacts

No impacts of the project resulting from its interaction with other existing or proposed projects are anticipated. No mitigation and monitoring measures are proposed.

## 5.5 Environmental Plan of Action

The following elements comprise the Environmental Plan of Action for the sites, as applicable to project activities.

**Commissioning Phase**

The Commissioning Phase of the project is divided into Health and Safety and Training and Capacity Building as described below.

Health and Safety--

The following health and safety issues will be incorporated into the Environmental Plan of Action:

- Assign a project Health and Safety Manager.
- Assign responsibilities within the contractor and project's supervision team.
- Surround specific hazardous areas of the installation site with a fence to prevent unauthorized access to the site.
- Delineate routes and installation sites and post clear signs of warning from installation risks.[MSOffice7]
- Inform local residents and other users of the area of the equipment installation and construction schedule.

Training and Capacity Building--

Training for contractors concentrated on the following main topics:

- Health and safety of workers and the public.
- Remediation technologies and methods to implement differing remediation options.

This training concentrated on the two main topics listed above. Areas that were included in the training included the following:

- Introduction to hazardous waste remediation requirements in Egypt.
- Evaluation of hazardous materials and wastes.
- Design/Remediation of hazardous waste and contaminated properties.
- Specialized safety measures for hazardous waste site remediation.
- Environmental compliance monitoring.
- Hazardous waste remediation business opportunities in Egypt.

**Implementation Phase**

The following topics will be included in the Implementation Phase of the Emergency Plan of Action.

Health and Safety--

The following health and safety topics will be included in the Implementation Phase:

- Regular control of health and safety measures by the designated contractor and project supervisors.

- Use of personal protective equipment and safety harness to prevent falling.

- Adherence to strict public health and safety standards.

- Proper storage of materials and the necessary provision of measures to prevent leaks and spills.

- Proper labelling of stockpiled material, proper access control measures to prevent accidental exposure, and the provision of protection equipment and first-aid kits.

- Storage of flammable materials (e.g., solvents), if any, in isolated, shaded, and well ventilated areas.

Emission Control--

The following emission control measures will be included in the Implementation Phase:

- Maintain machinery and vehicles in good working conditions to minimize fugitive emissions.

- Use of dust control measures such as water spraying for dust suppression.

Noise Control--

Machinery and vehicles will be maintained in good working condition during the Implementation Phase to minimize noise levels.

Inventory Control--

A "first-in, first-out" policy will be applied and auxiliary material, such as chemicals, will be properly labelled with their name, date of purchase, and date of expiration.

Housekeeping--

The following good housekeeping practices will be followed during the Implementation Phase:

- Minimization of the amount of wash water used.
- Minimization of spills during handling, transport, and use of products.

Waste Management--

Waste management is a very important consideration since large quantities of contaminated material will be excavated. Responsibility for waste that is generated will be clearly specified and will follow the procedure listed below.

- Store excavated contaminated soil, waste piles, and other contaminated materials, prior to transportation to landfill sites in a designated location.

- Transport and dispose the waste produced in properly designated and approved disposal sites to minimize negative environmental and health impacts.

- Contain demolition material from the buildings and temporary construction facilities for disposal at the designated disposal location

Emission Control--

The following emission control measures will be included in the Implementation Phase:

- Construct exterior and interior construction pads around the buildings to control dust emissions.

- Maintain machinery and vehicles in good working conditions to minimize fugitive emissions.

Maintenance Program--

The following procedures will be included in the maintenance program for the Implementation Phase:

- Regular checks and cleaning of equipment to insure proper working order.

- Repair of damaged equipment immediately.
- Maintain records of equipment checks, repairs, cleaning, and equipment failure to minimize equipment breakdown and any associated pollution releases.
- Prepare a maintenance schedule for mechanical work as well as periodic replacement of parts before breakdown occurs.
- Regular control of the compliance of the measures by the designated supervisors.

### Environmental Analyses

Life-Lead will initiated the necessary environmental analysis activities to address the issues identified for Environmental Assessment in December 2004. Table 5.1 provides a detailed schedule for environmental analyses. The baseline data has already been collected and included in this EA. Additional data detailed in the above sections will be collected prior to and at the end of the remediation activities starting in July 2005.

**Table 5.1: Schedule of Environmental Analyses**

| Media to be Analyzed | Dates for Analyses | | |
|---|---|---|---|
| | Inclusion in the EA | Prior to Remediation | Completion of Remediation |
| **Air Quality** | April 2005 | June 2005 – For School<br><br>December 2005 - For Smelters | Monitoring will be continuous during the remediation process using data provided by EEAA. |
| **Noise** | | June 2005 – For School<br><br>December 2005 – For Smelters | Monitoring will be continuous if needed during the remediation process. |
| **Soil** | Site characterization information will be included in the EA for each of the smelters and the school. | | Clearance sampling will be conducted following the completion of remediation activities.<br><br>September 2005 – For the School<br><br>May 2006 – For Smelters |
| **Groundwater Quality – Remediation Area** | April 2005 | December 2005 – Prior to remediation of the smelters. | June 2006 – Following completion of the smelter remediation activities. |
| **Groundwater Quality – Abu Zabaal Landfill** | April 2005 | | June 2006 – Following completion of the smelter remediation activities. |
| **Surface Water Quality** | April 2005 | December 2005 – Prior to remediation of the smelters. | June 2006 – Following completion of the smelter remediation activities. |
| **Sediment Sampling – Ismailia Canal** | April 2005 | December 2005 – Prior to remediation of the smelters. | June 2006 – Following completion of the smelter remediation activities. |

## 5.6 Risk Prevention and Emergency Response

### 5.6.1 Objectives

The Emergency Response Plan (ERP) was developed to provide the following control measures:

- Identification of potential sources of hazards that may be present during the lead remediation activities.
- Identification of the chain of events that may occur and result in environmental risk.
- Qualitative evaluation of the likelihood of the occurrence of each of these events.
- Qualitative assessment of the severity of the potential consequences.
- Ranking of the environmental risks in terms of severity.
- Recommendation of appropriate mitigation measures and emergency response procedures to properly manage the identified risks.

### 5.6.2 Applicability

The Emergency Response Plan was developed for the remediation option which was deemed most favourable as a result of the multi-criteria analysis. It has been prepared as a guideline document to provide contractors with procedures that will allow them to identify risk situations and to respond appropriately to emergencies that may occur during project implementation. Life-Lead will require contractors to modify and update the plan periodically during the remediation process as needed. Table 5.2 provides a detailed summary of the environmental risks.

**Table 5.2: Summary of Environmental Risks**

| Hazard Type | Prevention Measure | Hazard Rating | Response (Table 5.3) |
|---|---|---|---|
| **Onsite Storage and Handling of Hazardous Materials (All Sites )** | | | |
| Spills associated with liquids causing impacts to soil and the possibility of fire. | Worker training on chemical handling and storage and provision of proper containment mechanisms | Moderate | SP, ME, FE |
| Hazards associated with human contact with chemicals. | Workers training, strict operational procedures, and containment practices. | Moderate to high | SP, ME |
| **Decontamination of Building and Building Improvements ( All Sites )** | | | |
| Accidents involving workers slipping, tripping, or falling; and resulting from the use of equipment. | Worker training, use of PPE at all times, exercising common sense, and using harnesses and wires when working on elevated surfaces. | Low to moderate | ME |
| **Removal of Contaminated Soil ( All Sites, except the 3 Awadallah Sites )** | | | |

| Hazard Type | Prevention Measure | Hazard Rating | Response (Table 5.3) |
|---|---|---|---|
| Accidents with heavy equipment caused by human errors. | Strict operational procedures and proper worker training. | Low to moderate | ME |
| Slope failure, due to operational problems. | Quality control and supervision during construction activities, training and monitoring. | Low | SF, ME |
| **Transportation Accidents ( All Transportation Routes )** | | | |
| Accidents during transportation causing personal injury and spills onsite or along the road to the final disposal site(s) | Strict safety procedures for drivers, regular vehicle maintenance, appropriate containment of waste while transporting, and vehicle escort service as practicable. | Moderate to high (human error is an important factor that needs to be managed) | TR |

Specific emergency response procedures are developed for each type of emergency situation (e.g., transport accident, fire, etc.) and facilities involved based on the general principles outlined in Table 5.3.

## Table 5.3: Guidelines for Response Procedures

| Ref. | Risk Situation | Potential Substances or Facilities Involved | Hazard | Key Elements of the Emergency Response Plan |
|---|---|---|---|---|
| TR | Transportation | Transport within and near the school site, and along long access roads to the Abu Zaabal (non hazardous waste) and Al Nasereya (hazardous waste) Landfills | Injury or fatality, and spill of transported materials | Notification and containment of spills on-site or near-site as per procedures in Item SP.<br><br>Medical emergencies will adopt procedures as per Item ME.<br><br>For fires located along the transport route, the following will be applied:<br>• Each truck will be equipped with a fire extinguisher that will vary depending on the material being shipped.<br>• For small fires, dry chemical $CO_2$ extinguishers will be used.<br>• For large fires, the fire area will be flooded with water from a distance. The water jet will not be projected over the spilled material. Water will not be used if the material is acidic. Vehicles will be equipped with proper fire extinguishing materials.<br>• The truck will be removed from the fire area if possible without invoking further risk.<br>• Water will be applied to the shipment to cool the sides exposed to flames until the container is within normal temperatures.<br>• Workers will stay at a safe distance from the burning materials. |

| Ref. | Risk Situation | Potential Substances or Facilities Involved | Hazard | Key Elements of the Emergency Response Plan |
|---|---|---|---|---|
| SP | Spills | Solvents and chemicals used to remove paints. Paint materials for walls. | Potential health hazard due to ingestion, inhalation, or dermal contact. Possible flammability and corrosivity depending on chemical. | Notification of emergency to the Site Engineer and the Egyptian Environmental Affairs Agency. |
| ME | Medical Emergencies | On site, all activities. | Injuries to workers. | The contractor will have a specialized person (or a person of the team) on site and at all times who is trained in the disciplines of first aid, CPR, fire rescue, and evacuation. All workers will be trained in the proper response to specific injuries (e.g., not moving workers with potential spinal injuries). The injured workers will be transported to the local medical facility.<br><br>The following procedure will be employed at the location of the incident:<br>• Assess the location and severity of the situation.<br>• Avoid taking health or safety risks by entering a dangerous or unstable area.<br>• Restrict access to the area.<br>• Notify the Health and Safety Manager.<br>• Assist in extinguishing the fire and securing the area only under the direction of the Health and Safety Manager.<br>• Contact the local fire fighting authority to start mobilizing. |

| Ref. | Risk Situation | Potential Substances or Facilities Involved | Hazard | Key Elements of the Emergency Response Plan |
|---|---|---|---|---|
| SF | Slope failure of the excavation pit.. | Contaminated areas being excavated. | Injury to workers. | The following procedures will be employed at the location of the incident:<br>• Notification of emergencies to Health and Safety Manager.<br>• Definition of danger area.<br>• Assessment of the situation, including impacts to the environment and the workers.<br>• Attention to injured as per ME.<br>• Employment of measures for stabilizing the area. |
| FE | Fire within project site. | Onsite, particularly chemical or fuel storage areas. | Fire with potential subsequent damage to property, injury, or explosion. | Fire fighting equipment will be maintained onsite during all site operations.<br><br>Key procedures within the project site include the following:<br>• Assess the location and severity of the situation.<br>• Avoid taking health or safety risks by entering a dangerous or unstable area.<br>• Address life threatening issues such as the lack of pulse, blocked air passages, or severe bleeding using basic first aid techniques.<br>• Notify the Health and Safety manager/site manager according to established protocols.<br>• Assist in securing the situation and transporting the victim under the direction of the Health and Safety Manager on site. |

# APPENDIX A

## FIGURES OF SITE PLANS, LAND USE, DISPOSAL ROUTES AND WATER SAMPLE LOCATIONS

Exhibit 1

Site Plan for EL Shahid Ahmed Shalaan School

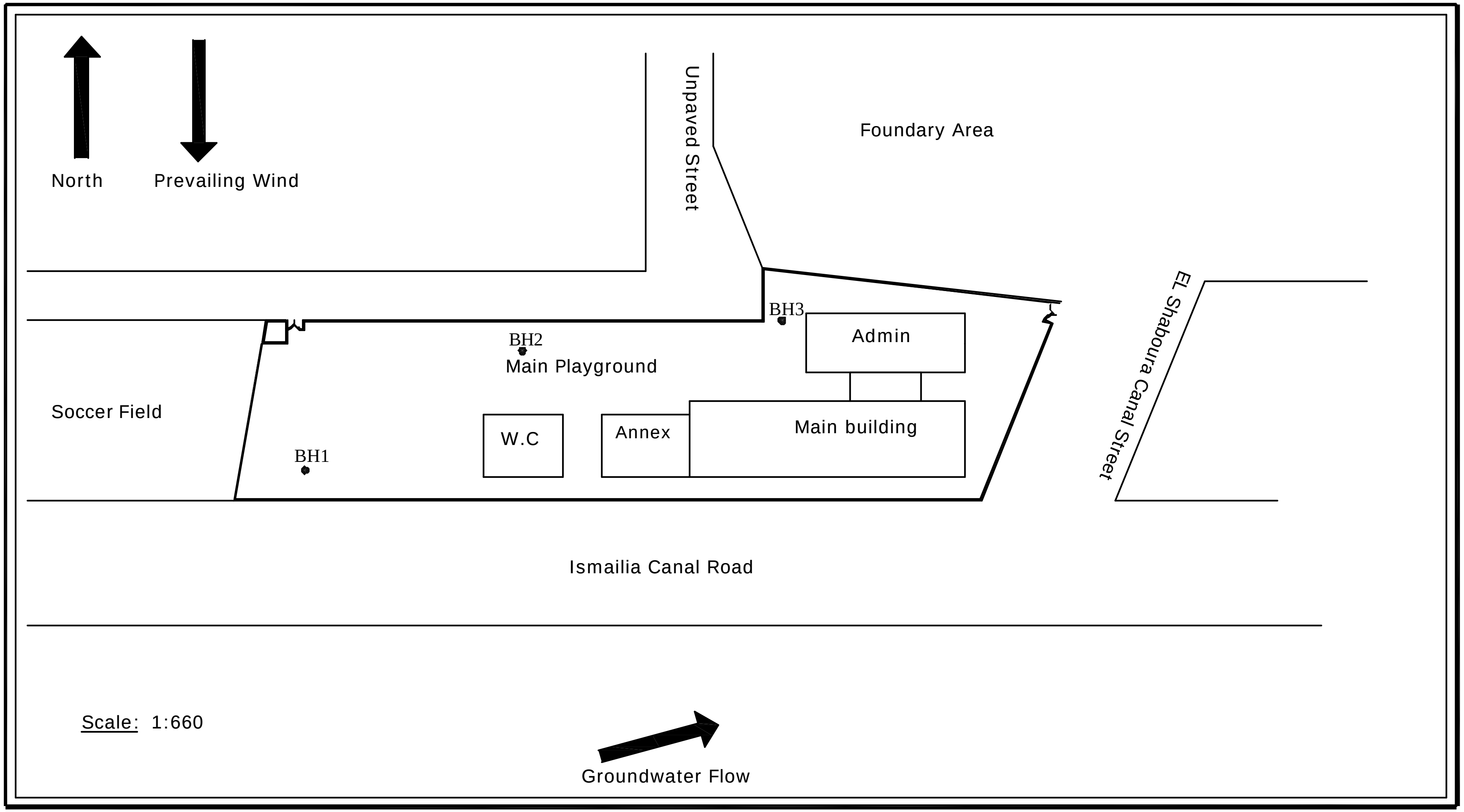


Exhibit 2

Location of Oprations inside Awadallah 1

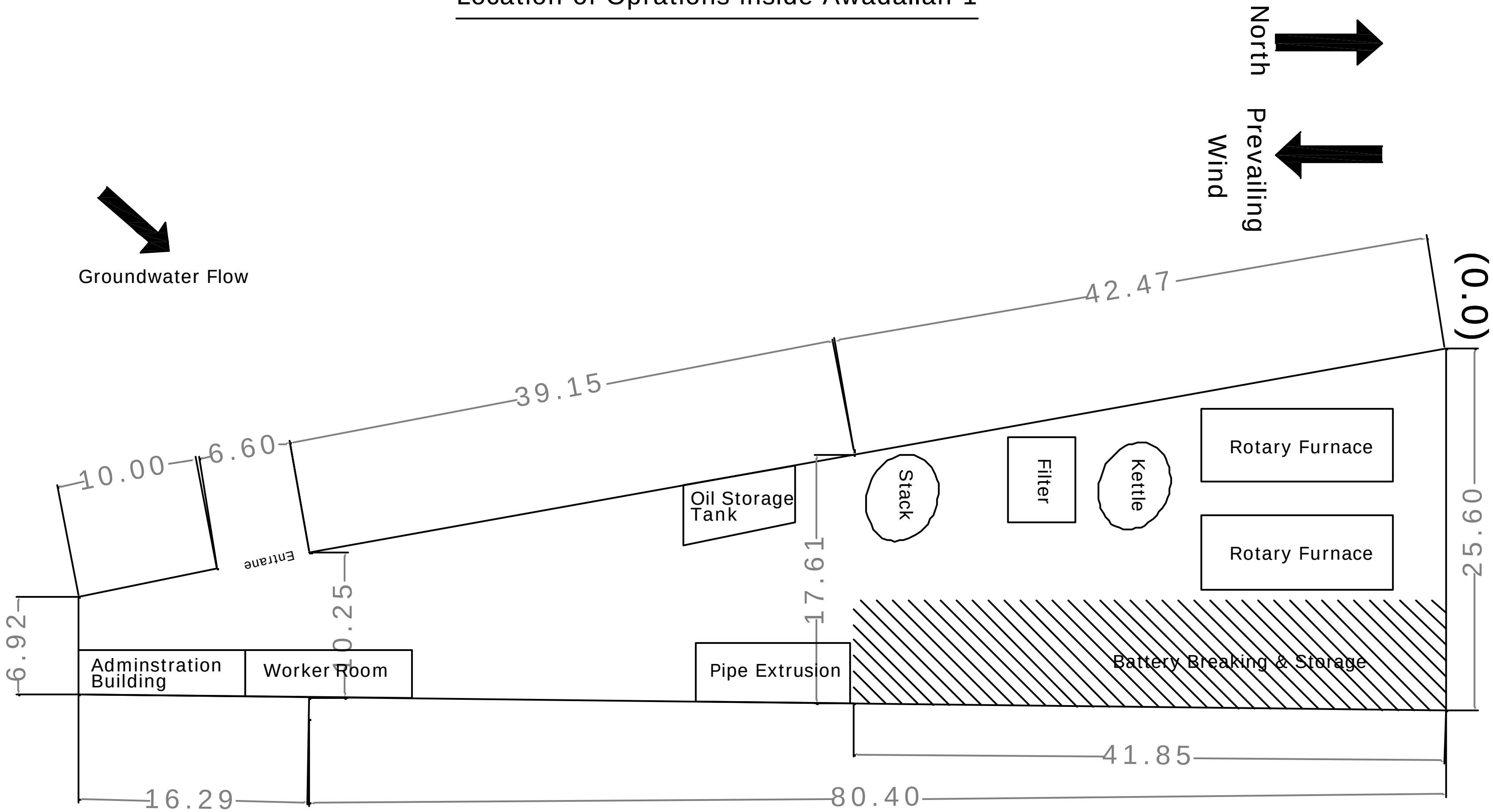


Exhibit 3

Location of Operations inside Awadallah 2

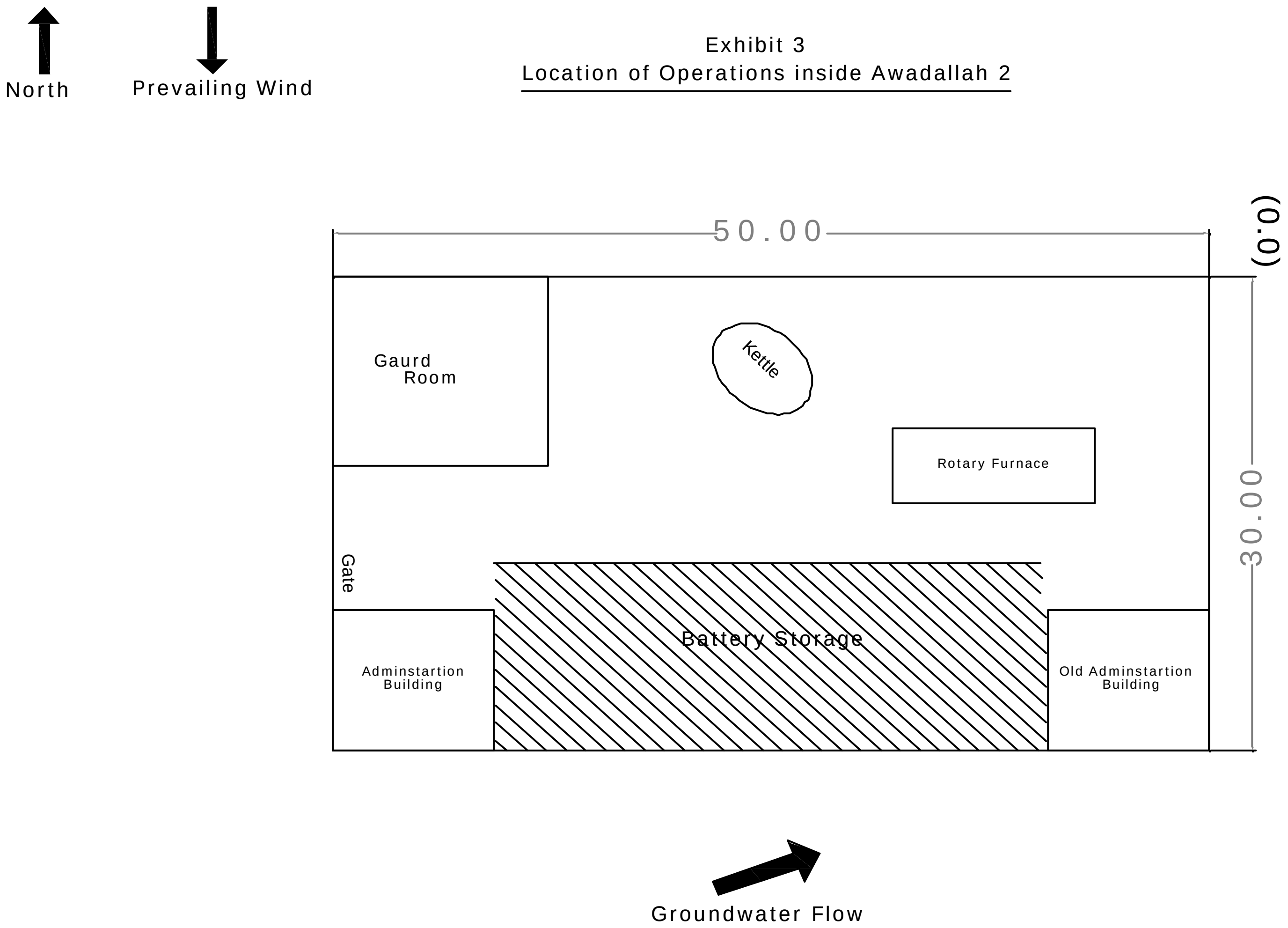


Exhibit 4

Location of Operations inside Awadallah 3

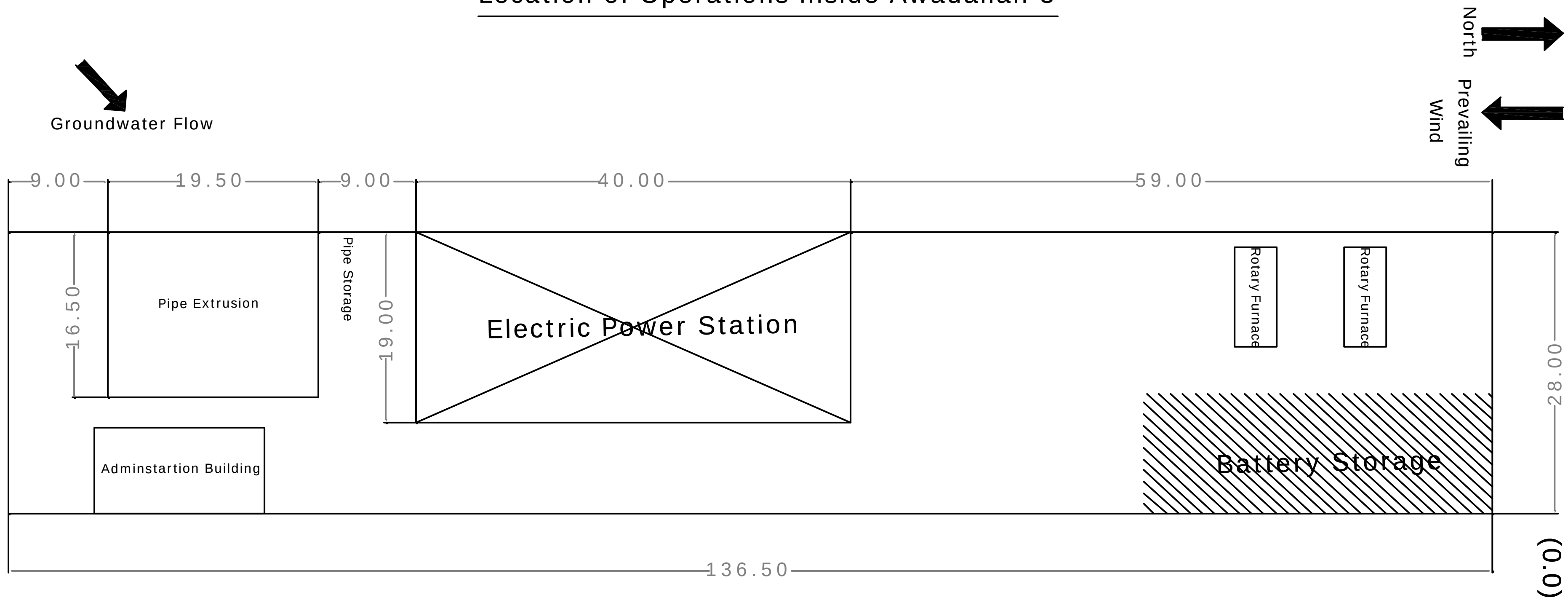
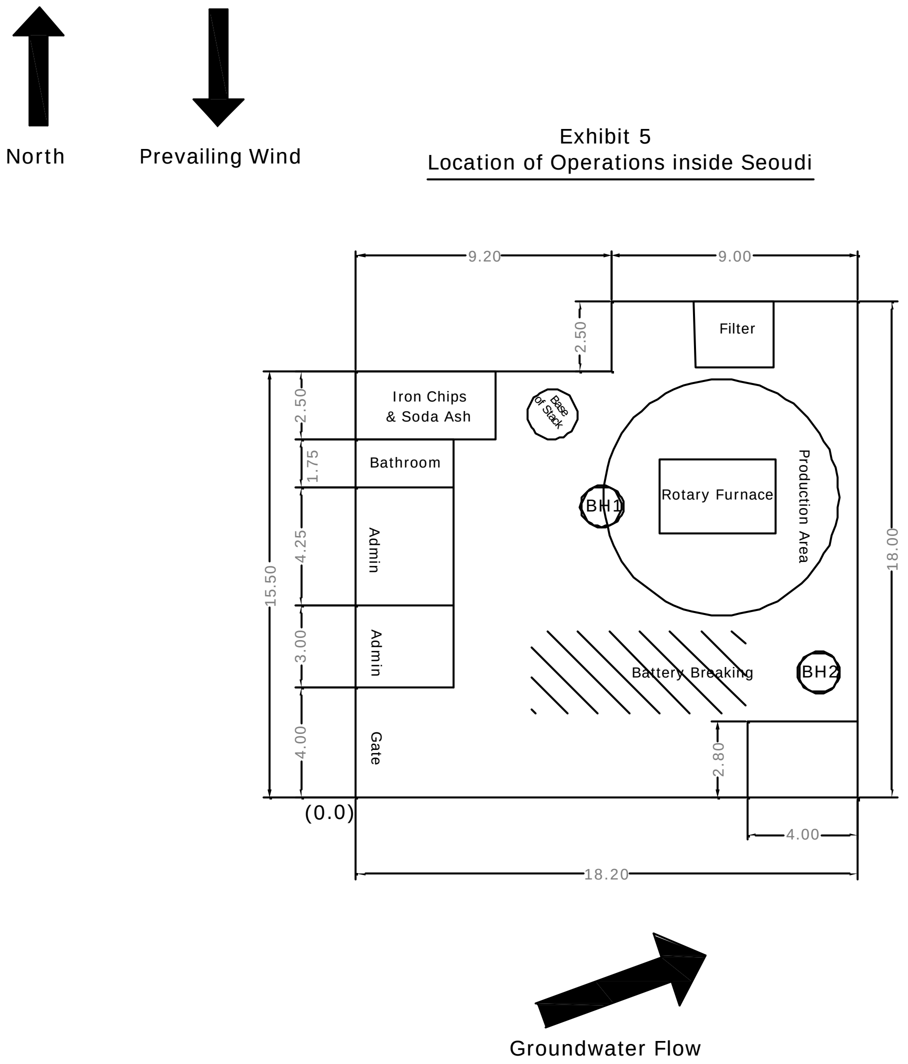
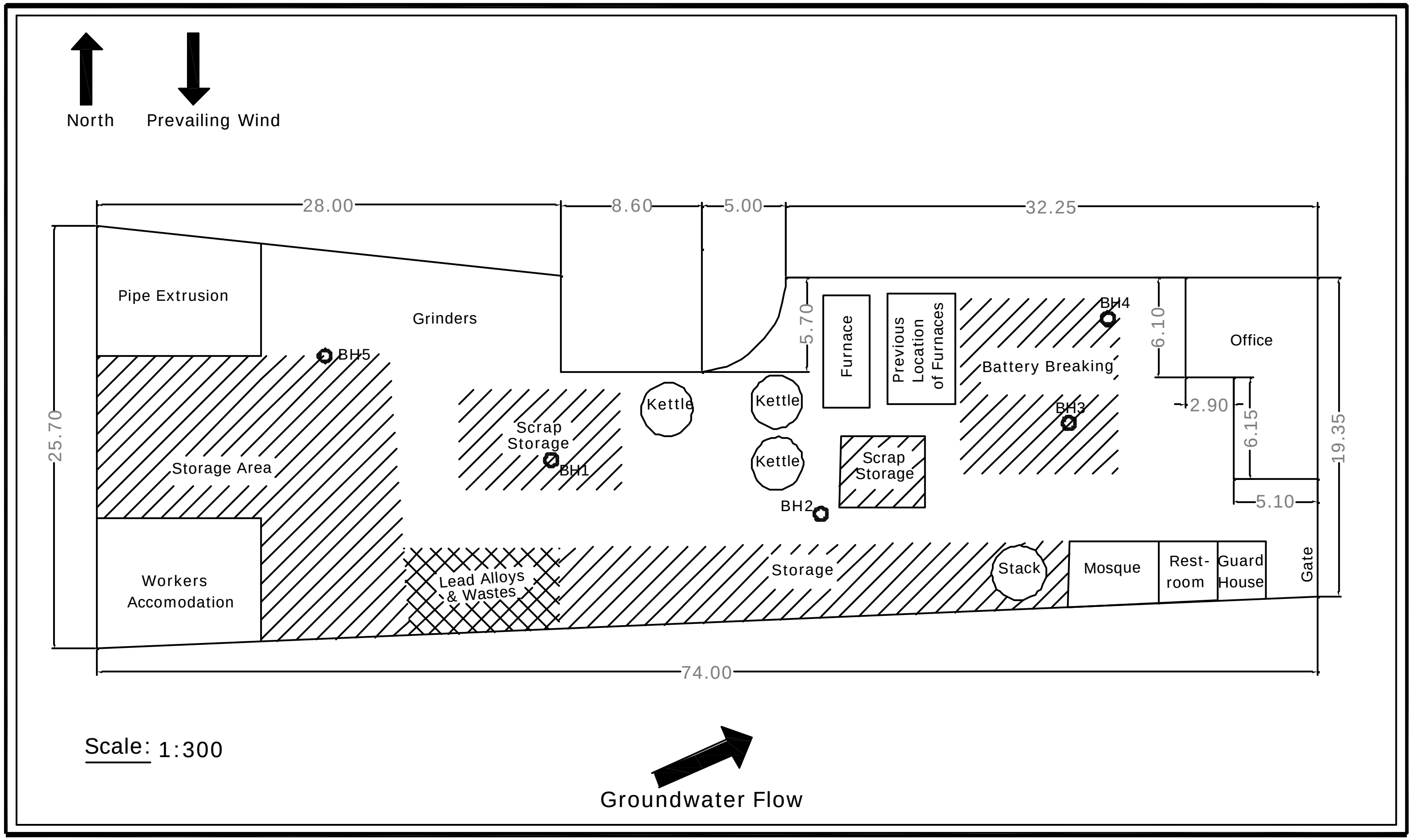


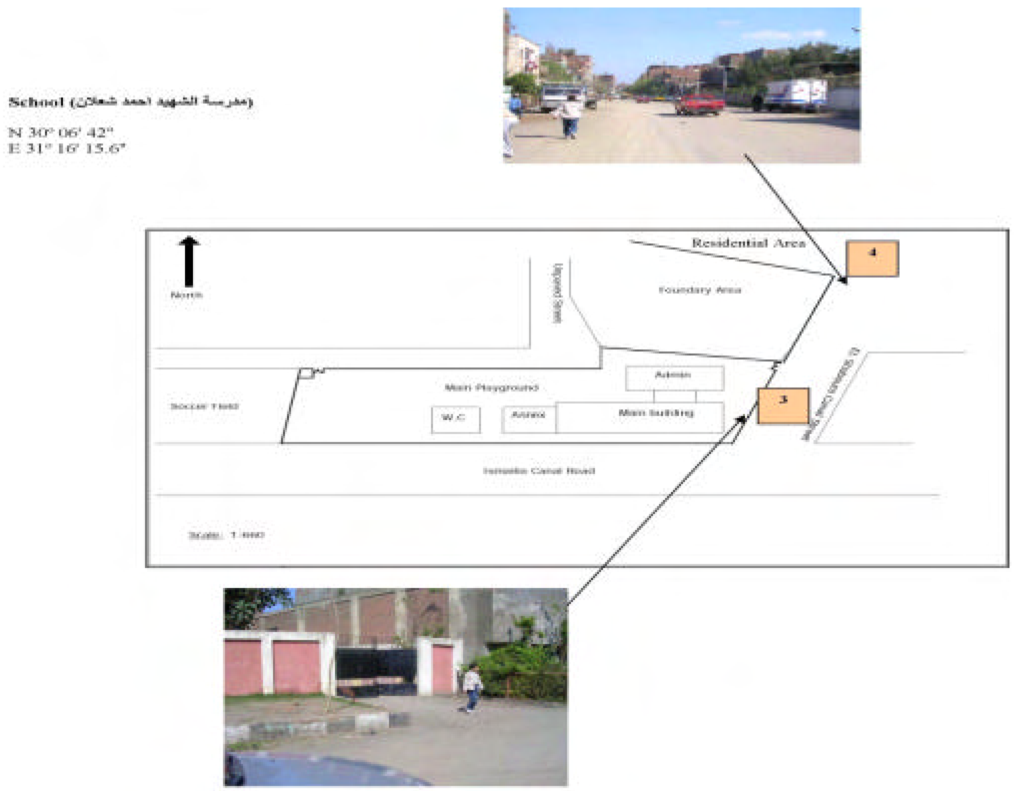
Exhibit 5
Location of Operations inside Seoudi



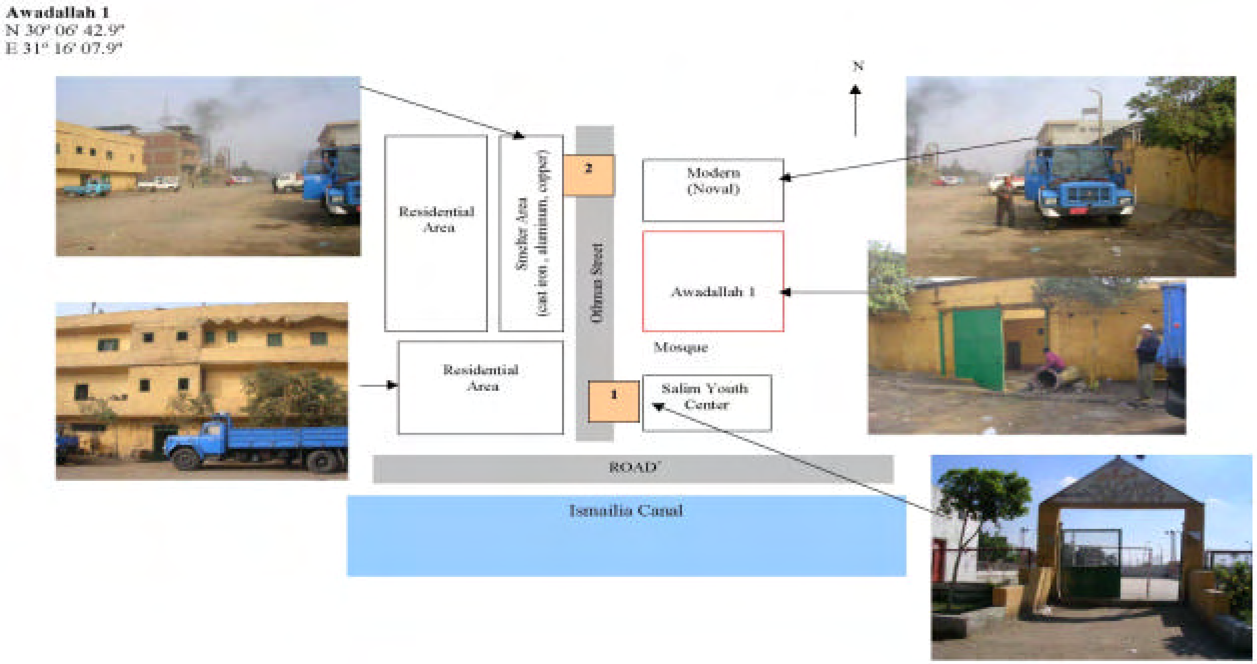
## Exhibit 6
## Site Plan for EL Mahy Smelter



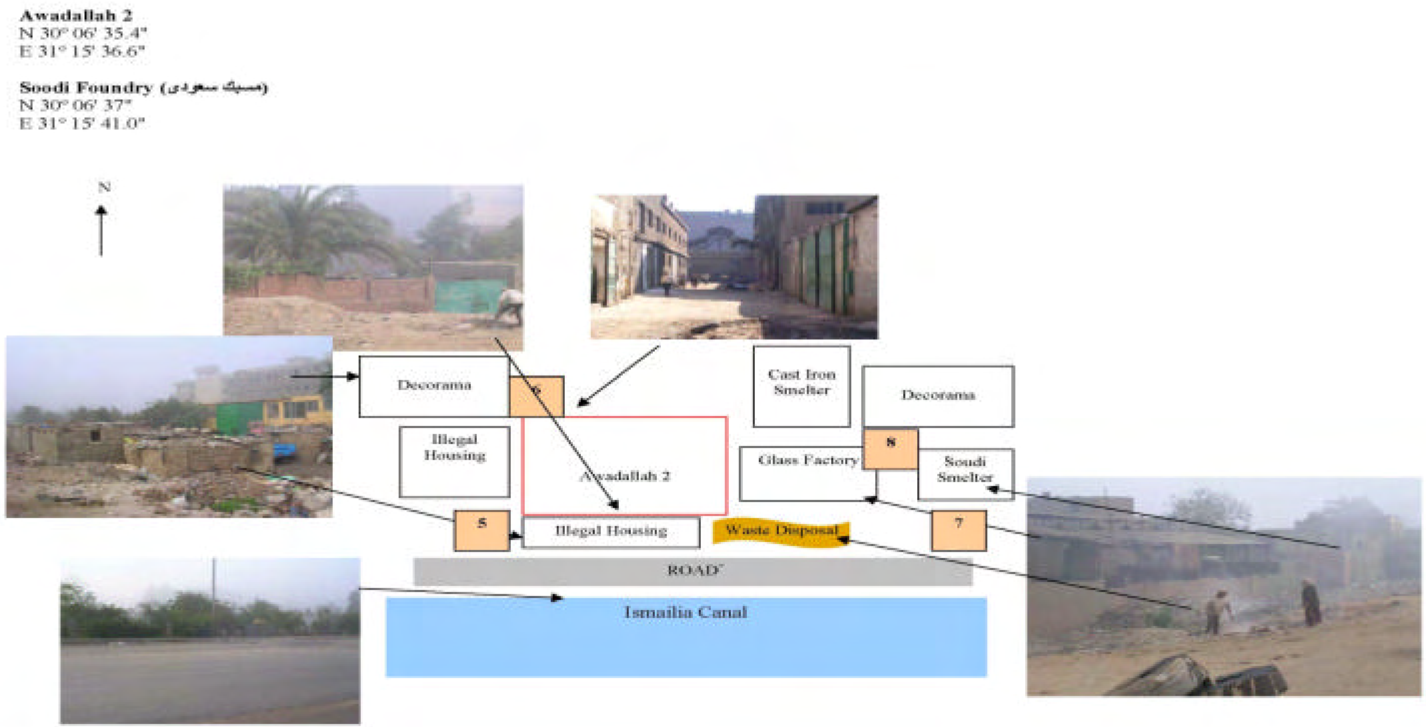
## Exhibit 7: Land Use around El- Shahid Ahmed Shalaan School



## Exhibit 8: Land Use around Awadallah Smelter No. 1



## Exhibit 9: Land Use Around Awadallah Smelter No. 2 and the Seoudi Smelter



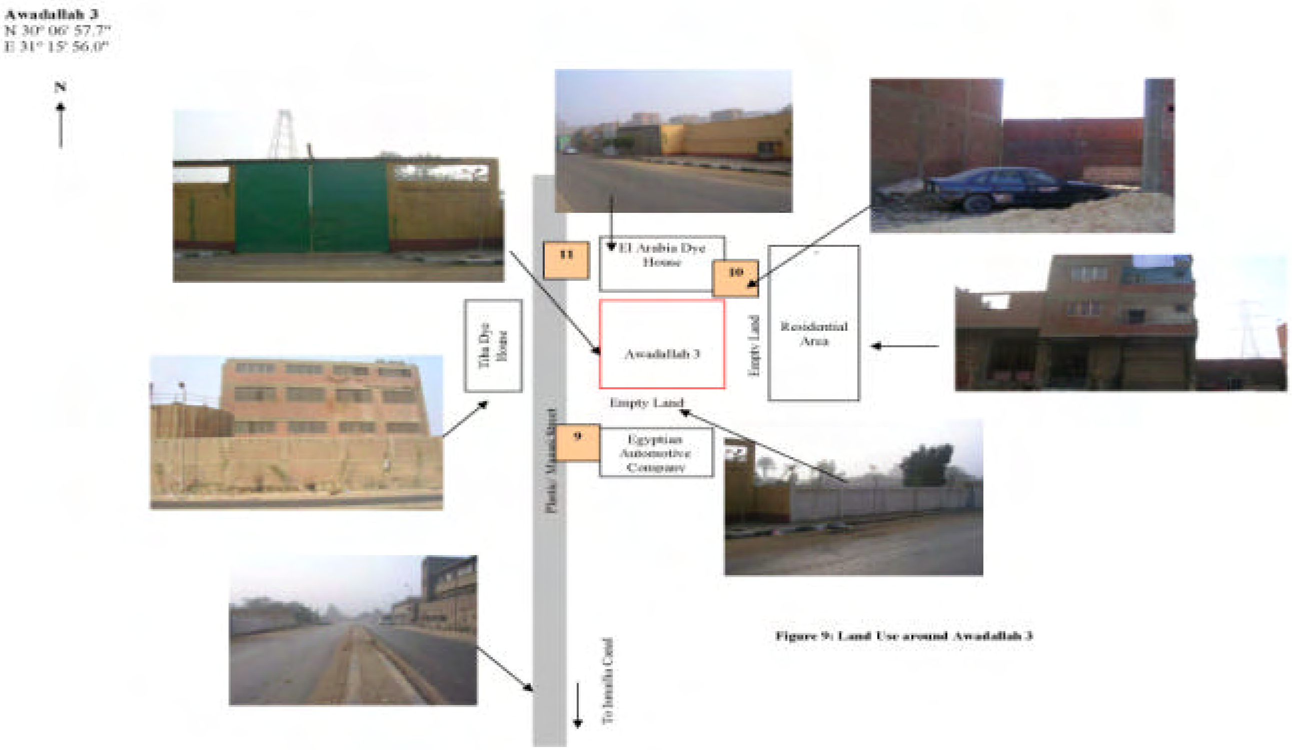



Figure 9: Land Use around Awadallah 3

**Exhibit 10: Land Use Around Awadallah Smelter No. 3**

## Exhibit 11: Land Use around El Mahy

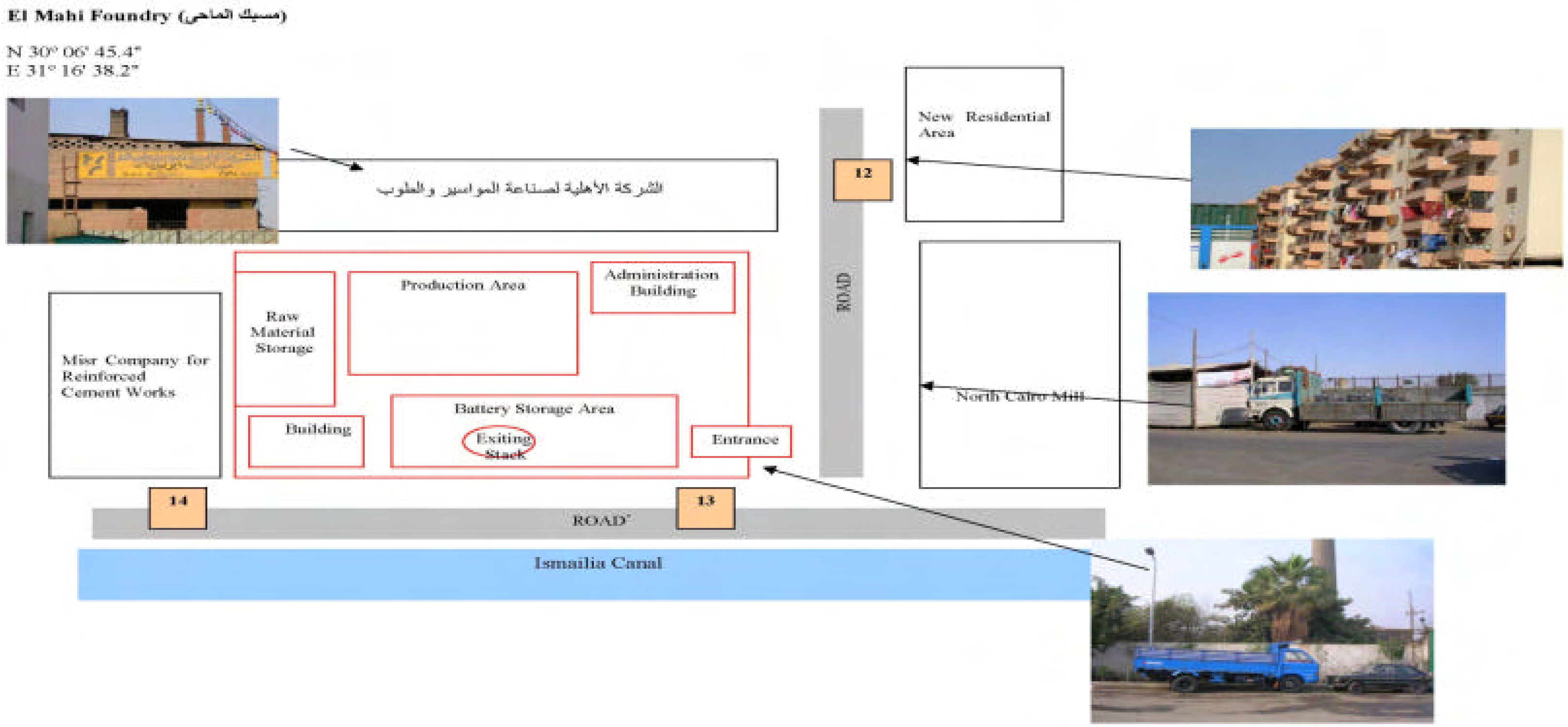


**Exhibit 12: Transportation Routes to Waste Disposal Sites; El Nasreya and Abu Zabaal**

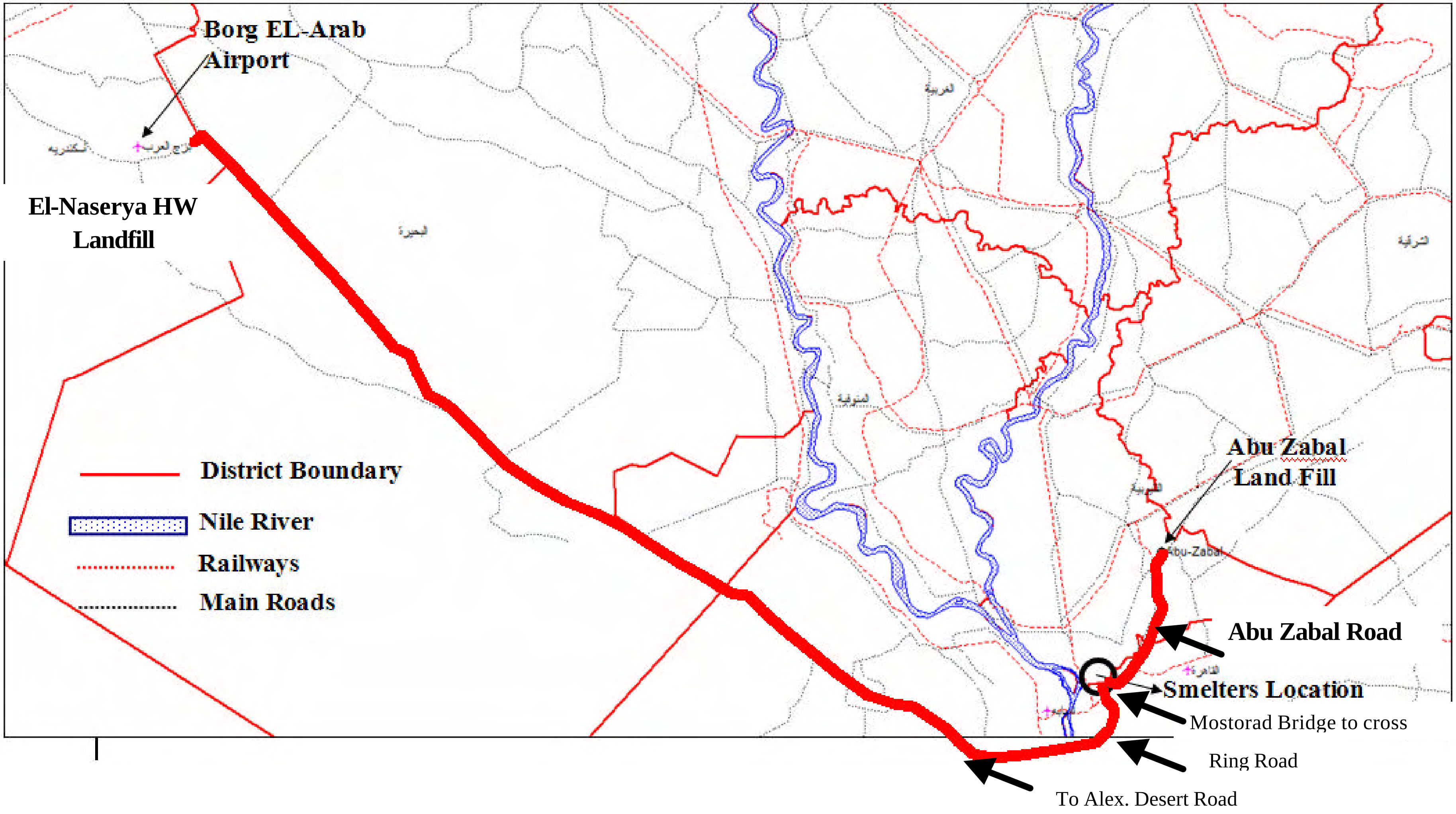


**Exhibit 13: Locations of the Water Sampling Around the Sites**

## Exhibit 14: Borehole No. 1 at El Shahid Ahmed Shalaan School

Project: Life Lead Pollution Clean-up in Shoubra EL-Kheima Qalubiya

*BH1*

Location: EL Shahid Ahmed Shalaan school

| SUBSURFACE PROFILE | | | SAMPLE | |
|---|---|---|---|---|
| Depth (m) | Symbol | Description | Elevation | Water Level |
| 0 – 1.5 | | Fill | -1.5 | |
| 1.5 – 2.5 | | Silty Clay | -2.5 | |
| 2.5 – 5 | | Brown Stiff Silty Clay with traces of mica | -5 | |

Depth scale: 0, 0.5, 1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5

Drill method: Rotary drilling

Drill date: April 2005

## Exhibit 15: Borehole No. 2 at El Shahid Ahmed Shalaan School

Project: Life Lead Pollution Clean-up in Shoubra EL-Kheima Qalubiya

*BH2*

Location: EL Shahid Ahmed Shalaan school

| SUBSURFACE PROFILE | | | SAMPLE | |
|---|---|---|---|---|
| Depth (m) | Symbol | Description | Elevation | Water Level |
| 0 – 0.5 | | Fill | -0.5 | |
| 0.5 – 1.5 | | Silty Clay | -1.5 | |
| 1.5 – 5 | | Brown Stiff Silty Clay with traces of mica | -5 | |

Depth scale: 0, 0.5, 1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5

Drill method: Rotary drilling

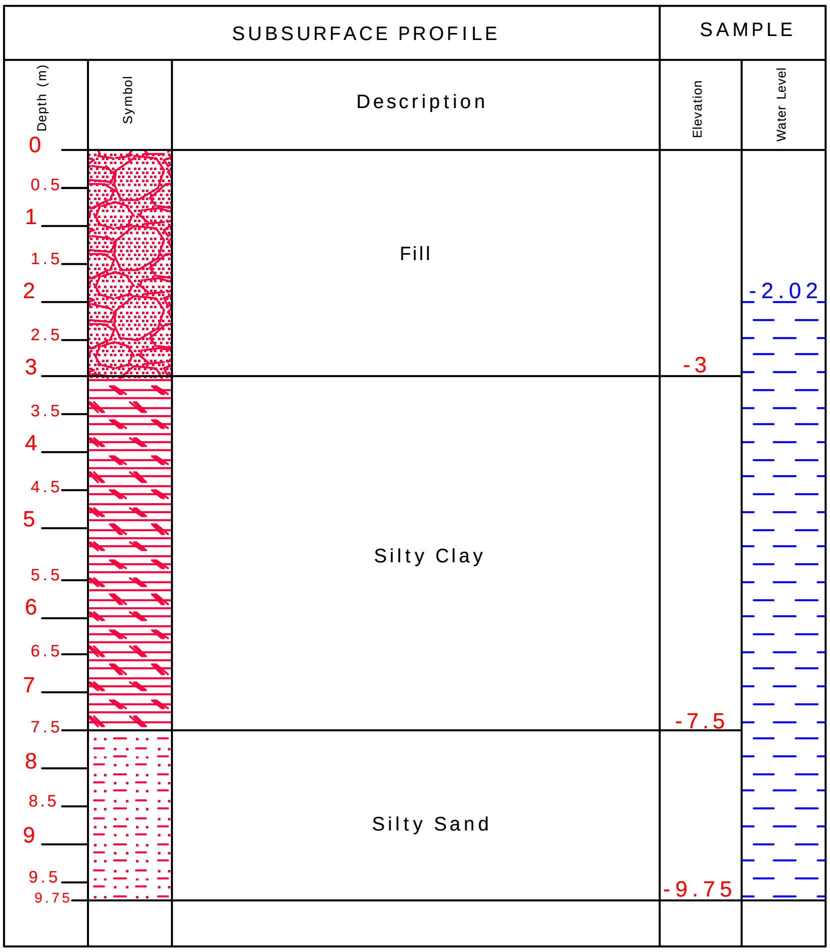
Drill date: April 2005

# Exhibit 16: Borehole No. 3 at El Shahid Ahmed Shalaan School

Project: Life Lead Pollution Clean-up in Shoubra EL-Kheima Qalubiya

*BH3*

Location: EL Shahid Ahmed Shalaan school




Drill method: Rotary drilling

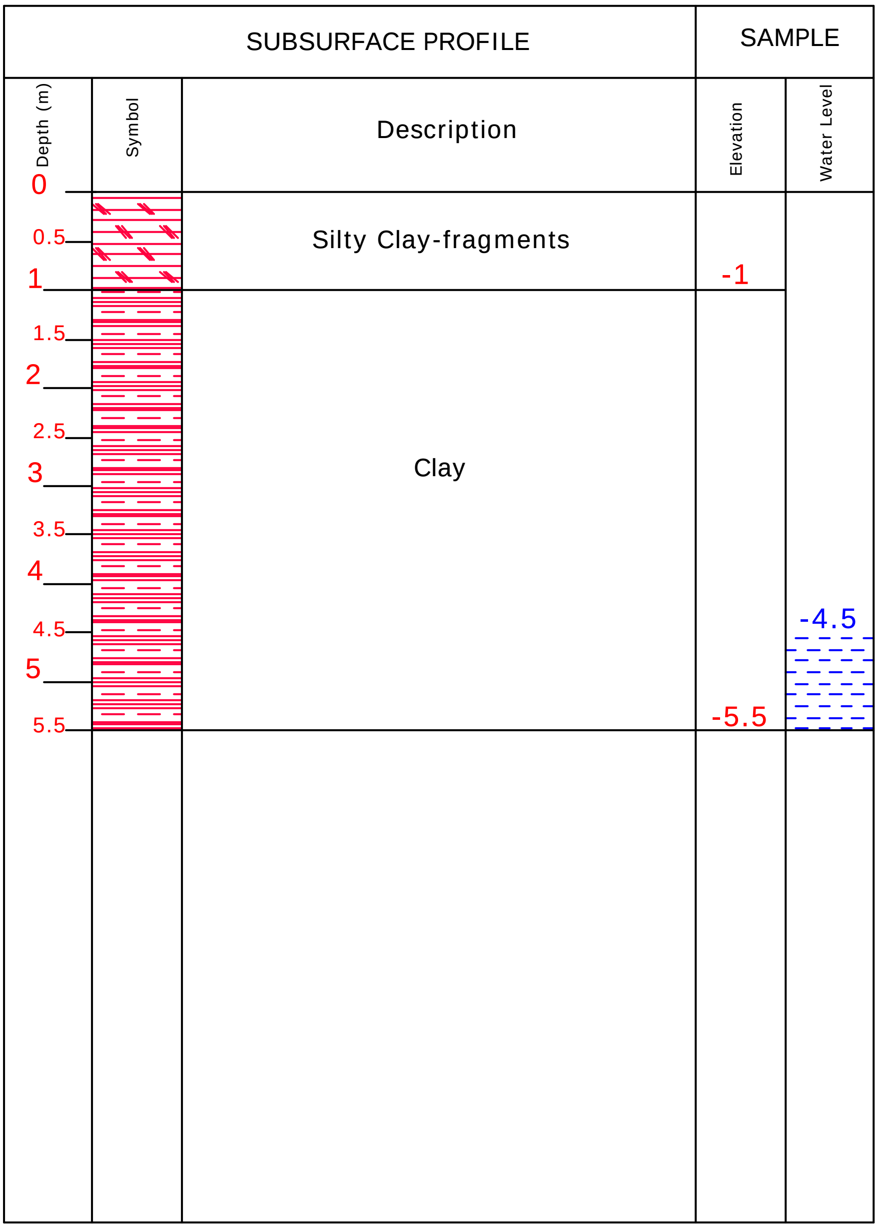
Drill date: April 2005

## Exhibit 17: Borehole No. 1 at Seoudi Smelter

Project: Life Lead Pollution Clean-up in Shoubra EL-Kheima Qalubiya

*BH1*

Location: Seoudi Smelter




Drill method: Rotary drilling

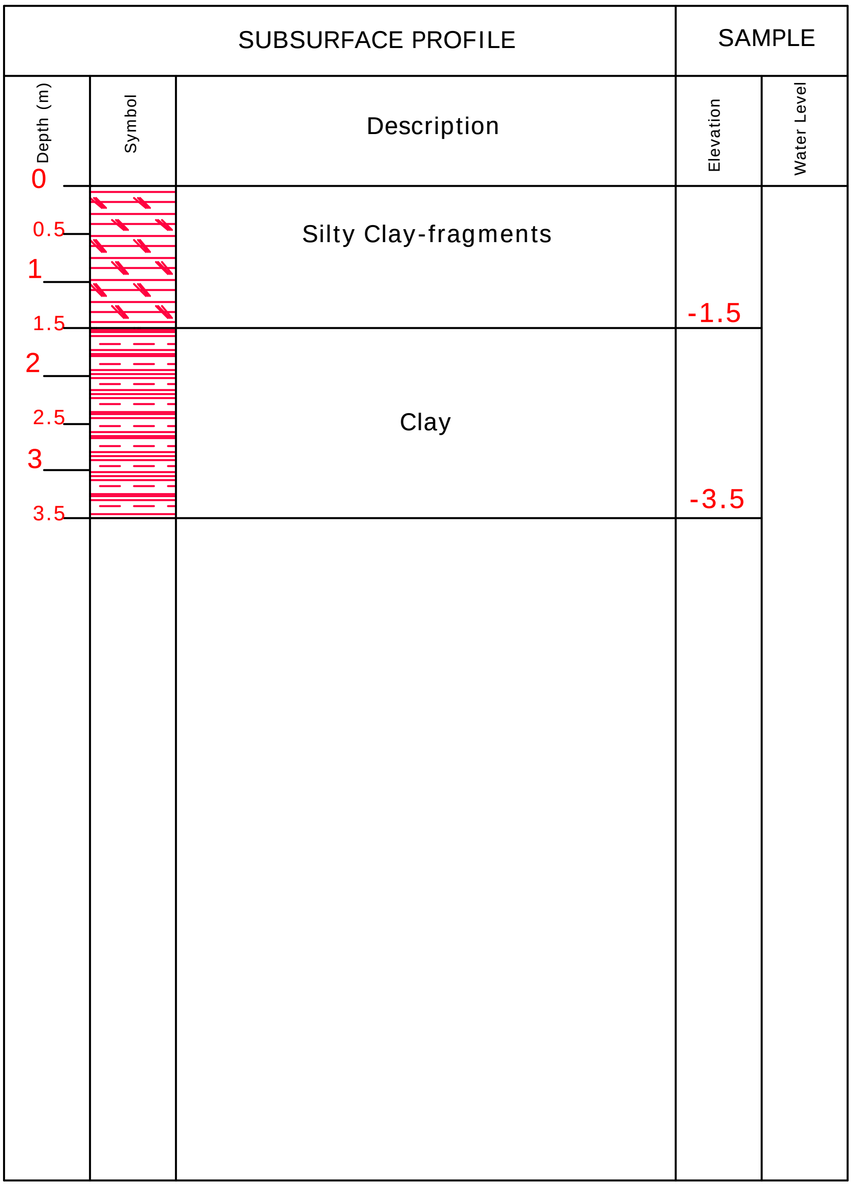
Drill date: December 2004

## Exhibit 18: Borehole No. 2 at Seoudi Smelter

Project: Life Lead Pollution Clean-up in Shoubra EL-Kheima Qalubiya

*BH2*

Location: Seoudi Smelter




Drill method: Rotary drilling

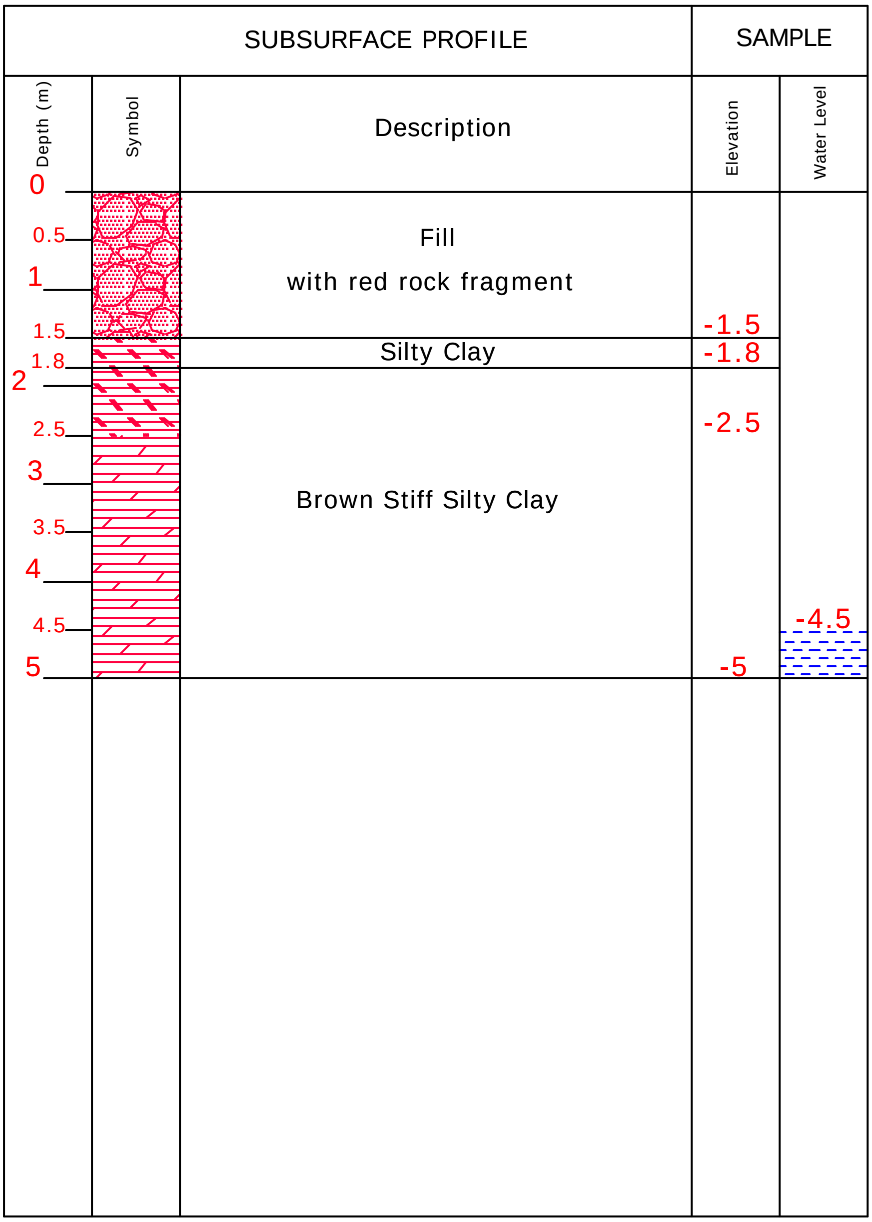
Drill date: December 2004

## Exhibit 19: Borehole No. 1 at El Mahy Smelter

Project: Life Lead Pollution Clean-up in Shoubra EL-Kheima Qalubiya

*BH1*

Location: EL Mahy Secondary Lead Smelter




Drill method: Rotary drilling

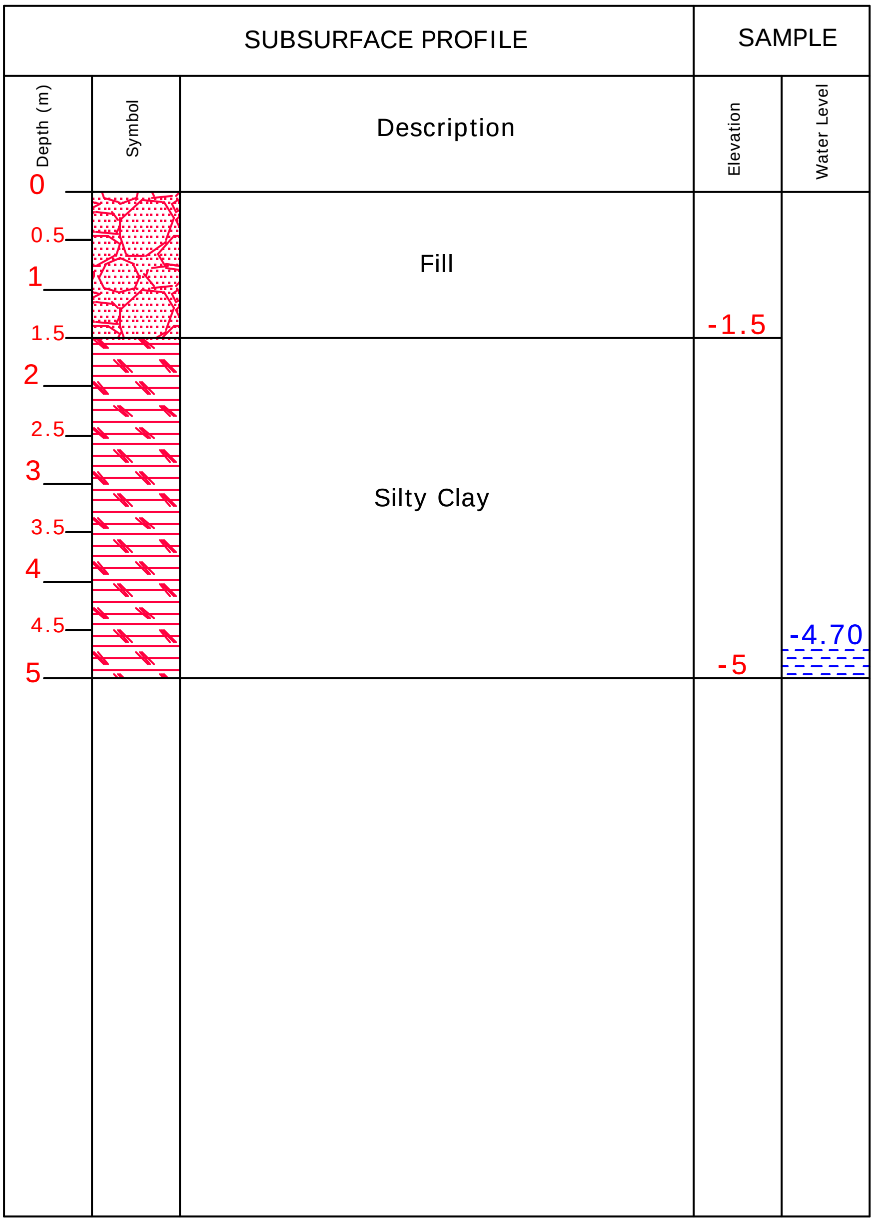
Drill date: April 2005

## Exhibit 20: Borehole No. 2 at El Mahy Smelter

Project: Life Lead Pollution Clean-up in Shoubra EL-Kheima Qalubiya

*BH2*

Location: EL Mahy Secondary Lead Smelter




Drill method: Rotary drilling

Drill date: April 2005

## Exhibit 21: Borehole No. 3 at El Mahy Smelter

Project: Life Lead Pollution Clean-up in Shoubra EL-Kheima Qalubiya

*BH3*

Location: EL Mahy Secondary Lead Smelter

| SUBSURFACE PROFILE | | | SAMPLE | |
|---|---|---|---|---|
| Depth (m) | Symbol | Description | Elevation | Water Level |
| 0 – 1.7 | | Fill | -1.7 | |
| 1.7 – 2.7 | | Reddish Grey Silty Clay | -2.7 | |
| 2.7 – 4 | | Grey Stiff Silty Clay | -4 | |
| 4 – 5 | | Brown Stiff Silty Clay | -5 | |

Drill method: Rotary drilling

Drill date: April 2005

## Exhibit 22: Borehole No. 4 at El Mahy Smelter

Project: Life Lead Pollution Clean-up in Shoubra EL-Kheima Qalubiya

**BH4**

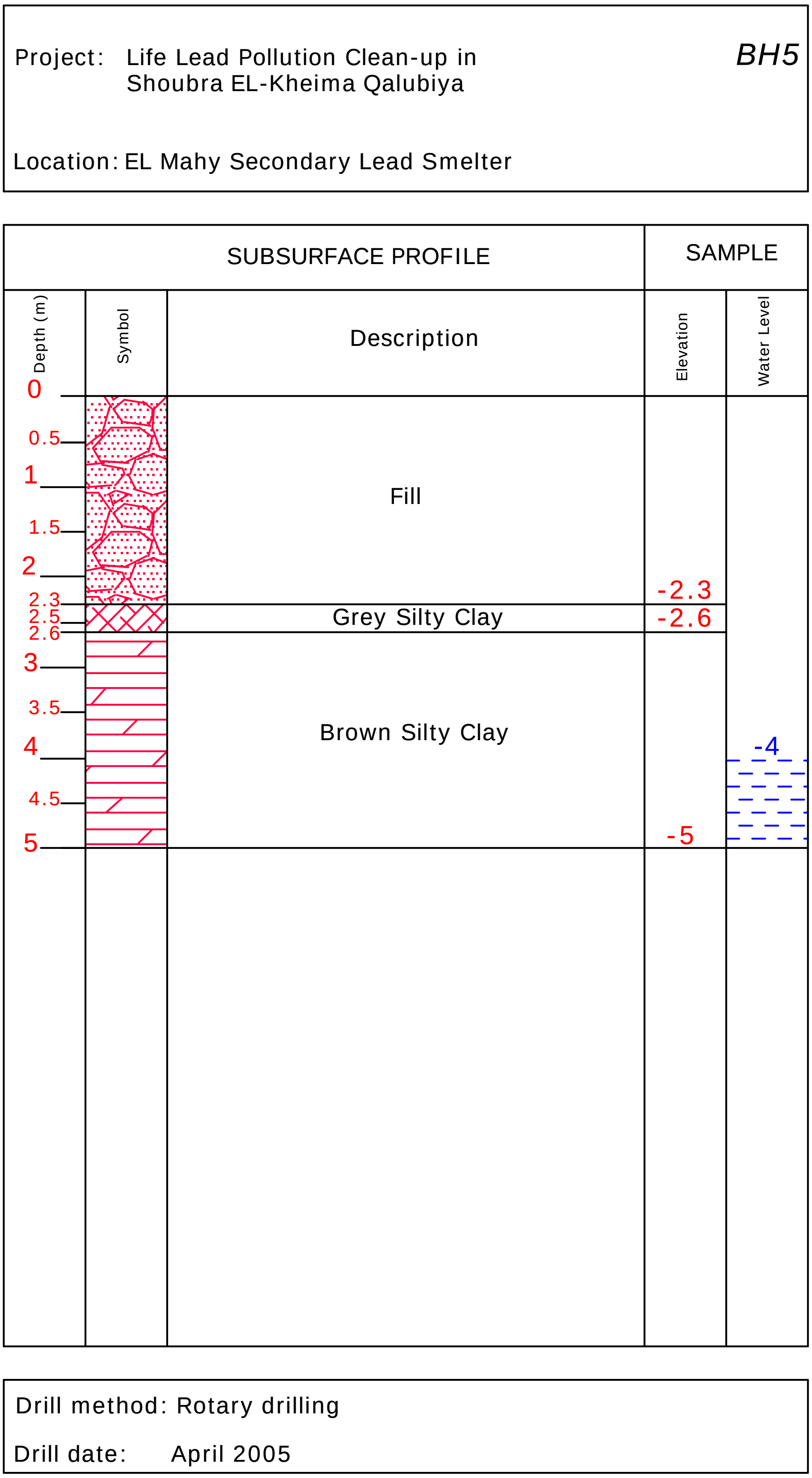
Location: EL Mahy Secondary Lead Smelter

| SUBSURFACE PROFILE | | | SAMPLE | |
|---|---|---|---|---|
| Depth (m) | Symbol | Description | Elevation | Water Level |
| 0, 0.5 | | Fill | -0.5 | |
| 1 | | Silty | -1 | |
| 1.3 | | Reddish Grey fragment Rock | -1.3 | |
| 1.5, 2, 2.1 | | Reddish Grey Silty Clay | -2.1 | |
| 2.5, 3, 3.5, 4, 4.5, 5 | | Brown Stiff Silty Clay | -5 | |

Drill method: Rotary drilling

Drill date: April 2005

## Exhibit 23: Borehole No. 5 at El Mahy Smelter



# APPENDIX B

## WATER QUALITY AND ANALYSES RESULTS AT SHOUBRA EL KHEIMA AND ABU ZABAAL
## Table 1: Water Quality Data for Shoubra El Kheima and Abu Zabaal Samples

| Location | Sample No. | Type of Sample | Grid Pos. X,Y | Depth m | Time of Sampling | Temp. ºC | pH | Ec µS | TDS mg/l | Alkalinity mg/l | NO2 mg/l | NO3 mg/l | NH4 mg/l |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Store at end of Kamal St. | 001 | Main | 0332115 3332316 | Unknown | 12:00 4/5/2005 | 23 | 7.69 | 320 | 204.8 | 145 | 0.099 | 22 | 2.34 |
| Beside Seoudi | 101 / 102 | Main / Duplicate | 0332471 3332264 | 15-17 | 10:25 4/5/2005 | 22 | 7.92 | 870 | 556.8 | 210 | 0.033 | 26.4 | 1.69 |
| Awadalla Smelter No. 1 | 201 / 203 | Main / Cross Ref. | 0332381 3332262 | 30+ | 10:40 4/5/2005 | 23 | 7.76 | 320 | 204.8 | 85 | 0 | 17.6 | 1.56 |
| El Elm Wa El Iman School | 301 | Main | 0332307 3332258 | | 10:55 4/5/2005 | 22 | 7.89 | 349 | 223.4 | 165 | 0.033 | 13.2 | 2.6 |
| Scrap Store Mokhles Anwar | 401 | Main | 0332605 3332291 | 20-25 | 11:05 4/5/2005 | 25 | 7.79 | 332 | 212.5 | 130 | 0.033 | 13.2 | 1.95 |
| Mobil Fuel Station | 501 / 502 | Main / Duplicate | 0333029 3332339 | 40 | 11:15 4/5/2005 | 23 | 7.55 | 459 | 293.8 | 165 | 0 | 22 | 1.04 |
| Iron Smelter Essam A. Hamid | 601 | Main | 0333176 3332411 | Unknown | 11:40 4/5/2005 | 21 | 7.72 | 429 | 274.6 | 135 | 0.066 | 26.4 | 1.17 |
| Iron Smelter Saad Tomas | 701 | Main | 0333258 3332439 | Unknown | 11:50 4/5/2005 | 23 | 7.53 | 456 | 291.8 | 185 | 0 | 13.2 | 2.47 |
| El Fotouh Cotton Factory | 801 | Main | 0333256 3332386 | 25 | 12:45 4/5/2005 | 23 | 8.11 | 494 | 316.2 | 195 | 0.066 | 17.6 | 2.21 |
| Misr for Concrete | 901 | Main | 0333810 3332609 | 18 | 13:15 4/5/2005 | 22 | 7.88 | 290 | 185.6 | 105 | 0.033 | 26.4 | 1.82 |
| El Ekhwa for Plastic | 1001 | Main | 0334053 3332759 | Unknown | 13:30 4/5/2005 | 23 | 7.47 | 1190 | 761.6 | 305 | 0.132 | 13.2 | 1.56 |
| El Masria for Tanks | 1101 | Main | 0334468 3332578 | Unknown | 13:40 4/5/2005 | 22 | 7.35 | 1460 | 934.4 | 145 | 0 | 17.6 | 1.69 |
| A. ElGabbar | 1201 | Main | 0332916 | 45 | 14:10 | 21 | 7.45 | 1260 | 806.4 | 280 | 0.033 | 22 | 2.08 |

| Location | Sample No. | Type of Sample | Grid Pos. X,Y | Depth m | Time of Sampling | Temp. ºC | pH | Ec µS | TDS mg/l | Alkalinity mg/l | NO2 mg/l | NO3 mg/l | NH4 mg/l |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dyeing Company | **1203** | **Cross Ref.** | 3332954 | | 4/5/2005 | | | | | | | | |
| The Honey | 1301 | Main | 0332858 | Unknown | 14:30 | 22 | 7.21 | 340 | 217.6 | 100 | 0.165 | 22 | 2.6 |
| Factory | | | 3332726 | | 4/5/2005 | | | | | | | | |
| Tiba | 1401 | Main | 0332791 | 70 | 14:50 | 22 | 6.55 | 740 | 473.6 | 110 | 0.066 | 30.8 | 1.95 |
| Dyeing Company | | | 3332946 | | 4/5/2005 | | | | | | | | |
| Metal Forming | 1501 | Main | 0333179 | Unknown | 15:15 | 23 | 7.46 | 1670 | 1069 | 195 | 0.033 | 17.6 | 2.6 |
| Workshop | | | 3332808 | | 4/5/2005 | | | | | | | | |
| Noval | 1601 | Main | 0333229 | 24 | 15:45 | 22 | 7.69 | 620 | 396.8 | 135 | 0 | 13.2 | 2.08 |
| Factory | | | 3332516 | | 4/5/2005 | | | | | | | | |
| House 22 Ter'at | 1701 | Main | 0333448 | Unknown | 16:10 | 23 | 7.44 | 890 | 569.6 | 235 | 0 | 22 | 2.6 |
| El Shaboura St. | | | 3332521 | | 4/5/2005 | | | | | | | | |
| Rashed Assal | 1801 | Main | 0332383 | Unknown | 16:45 | 22 | 7.67 | 980 | 627 | 285 | 0.033 | 17.6 | 1.69 |
| Smelter | | | 3332330 | | 4/5/2005 | | | | | | | | |
| Ismailia Monitoring | 1901 | Main | 0333183 | 6 | 16:15 | 22 | 7.63 | 2030 | 325 | 1299.2 | 0.099 | 22 | 2.08 |
| Well | | | 3332320 | | 4/6/2005 | | | | | | | | |
| Saad Tomas | 2001 | Main | | 20 | 10:05 | 23 | 7.51 | 686 | 125 | 439.04 | 0.165 | 17.6 | 2.6 |
| Monitoring Well | | | | | 4/6/2005 | | | | | | | | |
| Abu Zaabal | AZ101 | Main | N/A | N/A | 12:15 | 23 | 8.58 | 6370 | 4077 | 125 | 0.066 | 17.6 | 2.21 |
| Dumpsite | | | | | 4/6/2005 | | | | | | | | |
| Ashour El Sayed | AZ201 | Main | 0342591 | 9 | 12:40 | 22 | 7.8 | 9900 | 6336 | 60 | 0.132 | 13.2 | 2.34 |
| Imam House | AZ202 | Duplicate | 3350550 | | 4/6/2005 | | | | | | | | |
| Railway | AZ301 | Main | 0342372 | 12 | 12:50 | 23 | 7.23 | 1100 | 704 | 50 | 0.033 | 22 | 1.3 |
| Crossing | AZ303 | Cross Ref. | 3349962 | | 4/6/2005 | | | | | | | | |
| Abu Zaabal | AZ401 | Main | 0341676 | 9 | 13:55 | 21 | 7.33 | 600 | 384 | 75 | 0.132 | 17.6 | 3.25 |
| Mining Graves | | | 3350029 | | 4/6/2005 | | | | | | | | |
| A. Mawgood Abu | AZ501 | Main | 0341157 | 12 | 14:10 | 23 | 7.09 | 3000 | 192 | 50 | 0.099 | 13.2 | 2.47 |
| Youssef House | | | 3350559 | | 4/6/2005 | | | | | | | | |
| Ibrahim Abu | AZ601 | Main | 0341233 | Unknown | 14:30 | 24 | 7.05 | 1300 | 832 | 25 | 0.033 | 22 | 1.82 |
| Youssef Farm | | | 3352411 | | 4/6/2005 | | | | | | | | |
| In front ofArmenian | IW0101 | Surface water | 200m U.S | N/A | 17:40 | 20 | 7.77 | 300 | 192 | 200 | 0.066 | 17.6 | 2.21 |

| Location | Sample No. | Type of Sample | Grid Pos. X,Y | Depth m | Time of Sampling | Temp. ºC | pH | Ec µS | TDS mg/l | Alkalinity mg/l | NO2 mg/l | NO3 mg/l | NH4 mg/l |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Entrance to Abu Zabaal Landfill | **IW0103** | **Cross Ref.** | | | 4/5/2005 | | | | | | | | |
| | IS0101 | Sediment | | N/A | | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| In front of Ismailia Monitoring Well | IS0201 | Sediment | Awadalla-2 | N/A | 17:15 4/5/2005 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| In front of Egyptian Welding Academy | IW0201 | Surface water | 200m D.S | N/A | 18:15 | 21 | 8.35 | 300 | 192 | 65 | 0.132 | 22 | 2.21 |
| | IS0301 | Sediment | | N/A | 4/5/2005 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

**Table 2: Groundwater Samples Analysis Results at Shoubra El Kheima**[A8]

| SN | Location | GPS | | Sample Number | Lead (Pb) ppm |
|---|---|---|---|---|---|
| | | X | Y | | |
| 1 | Store at end of El Kamal Street | 0332115 | 3332316 | 001 | < 0.01 |
| 2 | Beside Seoudi Smelter | 0332471 | 3332264 | 101 | < 0.01 |
| 3 | Awadalla Smelter No. 1 | 0332381 | 3332262 | 201 | < 0.01 |
| 4 | El Elm Wa El Iman School (under construction) | 0332307 | 3332258 | 301 | < 0.01 |
| 5 | Scrap Store – Mokhles Anwar | 0332605 | 3332291 | 401 | < 0.01 |
| 6 | Mobil Fuel Station | 0333029 | 3332339 | 501 | < 0.01 |
| 7 | Iron Smelter – Essam Abdel Hamid | 0333176 | 3332411 | 601 | < 0.0207 |
| 8 | Iron Smelter – Saad Thomas | 0333258 | 3332439 | 701 | < 0.01 |
| 9 | El Fottouh Cotton Factory | 0333256 | 3332386 | 801 | < 0.01 |
| 10 | Misr for Concrete | 0333810 | 3332609 | 901 | < 0.01 |
| 11 | El Ekhwa for Plastic | 0334053 | 3332759 | 1001 | < 0.01 |
| 12 | El Masria for Tanks | 0334468 | 3332578 | 1101 | < 0.01 |
| 13 | Abdel Gabbar Dyeing Company | 0332916 | 3332954 | 1201 | < 0.01 |
| 14 | Honey Factory | 0332858 | 3332726 | 1301 | <0.0179 |
| 15 | Tiba Dyeing Company | 0332791 | 3332946 | 1401 | < 0.01 |
| 16 | Metal Forming Workshop | 0333179 | 3332808 | 1501 | < 0.01 |
| 17 | Noval Factory | 0333229 | 3332516 | 1601 | < 0.01 |
| 18 | House 22 Ter'at El Shaboura Street | 0333448 | 3332521 | 1701 | < 0.01 |
| 19 | Rashed Assal Smelter | 0332383 | 3332330 | 1801 | < 0.01 |
| 20 | Ter'at El Ismailia Monitoring Well (Shallow) | 0333183 | 3332320 | 1901 | 0.2089 |
| 21 | Saad Thomas Monitoring Well (Deep) | 0333258 | 3332439 | 2001 | 0.0178 |

**Table 3: Groundwater Samples Analysis Results at the Abu Zabaal Landfill**

| SN | Location | GPS | | Sample Number | Lead (Pb) ppm |
|---|---|---|---|---|---|
| | | X | Y | | |
| 1 | Abu Zaabal Disposal Site (surface water from a pit) | N/A | N/A | AZ101 | < 0.01 |
| 2 | Ashour El Sayed Emam House | 0342591 | 3350550 | AZ201 | < 0.01 |
| 3 | Railway Crossing | 0342372 | 3349962 | AZ301 | < 0.01 |
| 4 | Abu Zaabal Mining Graves | 0341676 | 3350029 | AZ401 | < 0.01 |
| 5 | Abdel Mawgood Abu Youssef House | 0341157 | 3350559 | AZ501 | < 0.01 |
| 6 | Ibrahim Abu Youssef Farm | 0341233 | 3352411 | AZ601 | < 0.01 |

**Table 4: Surface Water Samples from the Ismailia Canal**

| SN | Location | GPS | | Sample Number | Lead (Pb) ppm |
|---|---|---|---|---|---|
| | | X | Y | | |
| 1 | In front of Armenian Entrance | N/A | N/A | IW0101 | < 0.01 |
| 2 | In front of Egyptian Welding Academy | N/A | N/A | IW0201 | 0.0193 |

**Table 5: Sediment Samples from Ismailia Canal**

| SN | Location | GPS | | Sample Number | Lead (Pb) ppm |
|---|---|---|---|---|---|
| | | X | Y | | |
| 1 | In front of Armenian Entrance | N/A | N/A | IS0101 | 4.523 |
| 2 | In front of Ismailia Monitoring Well | N/A | N/A | IS0201 | 233.689 |
| 3 | In front of Egyptian Welding Academy | N/A | N/A | IS0301 | 19.195 |

**Table 6: Chemical Analysis of Soil Samples from the Boreholes at the School**

| Depth (m) | Boreholes | | | | | |
|---|---|---|---|---|---|---|
| | 1 | | 2 | | 3 | |
| | Lead Pb (ppm) | Water Level | Lead Pb (ppm) | Water Level | Lead Pb (ppm) | Water Level |
| 0.0-0.5 | 12.809 | Water Absent | 9.086 | Water Absent | 2.512 | |
| 0.5-1.0 | 2.437 | | 0.049 | | 1.009 | |
| 1.0-1.5 | 2.369 | | 0.047 | | 0.785 | |
| 1.5-2.0 | 2.181 | | 0.046 | | 0.768 | |
| 2.0-2.5 | 0.048 | | 0.047 | | 0.761 | |
| 2.5-3.0 | 0.049 | | 0.048 | | 0.423 | |
| 3.0-3.5 | 0.047 | | 0.047 | | 0.049 | |
| 3.5-4.0 | 0.047 | | 0.048 | | 0.048 | |
| 4.0-4.5 | 0.049 | | 0.049 | | 0.048 | |
| 4.5-5.0 | 0.046 | | 0.047 | | 0.046 | |

**Table 7: Chemical Analysis of Soil Samples from the Boreholes at Seoudi Smelter**

| Depth (m) | Boreholes | | | |
|---|---|---|---|---|
| | 1 | | 2 | |
| | Lead Pb (ppm) | Water Level | Lead Pb (ppm) | Water Level |
| 0.0-0.5 | 242,700 | | 401,700 | Water Absent |
| 0.5-1.0 | 3005 | | 56,875 | |
| 1.0-1.5 | 568 | | 119,365.0 | |
| 1.5-2.0 | 539 | | 86,755.0 | |
| 2.0-2.5 | 155 | | 595.7 | |
| 2.5-3.0 | 77 | | 552.0 | |

| Depth (m) | Boreholes | | | |
|---|---|---|---|---|
| | 1 | | 2 | |
| | Lead Pb (ppm) | Water Level | Lead Pb (ppm) | Water Level |
| 3.0-3.5 | 124 | | 1,650.6 | |
| 3.5-4.0 | 313 | | --- | |
| 4.0-4.5 | 218 | | --- | |
| 4.5-5.0 | 142 | | --- | |

**Table 8: Chemical Analysis of Soil Samples from the Boreholes at the El Mahy**

| Depth (m) | Boreholes | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | | 2 | | 3 | | 4 | | 5 | |
| | Lead Pb (ppm) | Water Level | Lead Pb (ppm) | Water Level | Lead Pb (ppm) | Water Level | Lead Pb (ppm) | Water Level | Lead Pb (ppm) | Water Level |
| 0.0-0.5 | 43,604.650 | | 51,169.720 | | 12,497.630 | Water Absent | 13,666.470 | Water Absent | 24,587.030 | |
| 0.5-1.0 | 37,118.120 | | 11,546.700 | | 1,390.500 | | 7,347.993 | | 21,155.430 | |
| 1.0-1.5 | 11,763.330 | | 2,133.872 | | 225.940 | | 1,029.673 | | 17,933.150 | |
| 1.5-2.0 | 9,115.370 | | 18.677 | | 131.384 | | 444.565 | | 15,205.260 | |
| 2.0-2.5 | 5.276.750 | | 4.977 | | 103.546 | | 350.069 | | 14,829.120 | |
| 2.5-3.0 | 636.992 | | 4.851 | | 68.742 | | 29,196 | | 12,336.330 | |
| 3.0-3.5 | 257.208 | | 4.811 | | 59.366 | | 4.949 | | 444.802 | |
| 3.5-4.0 | 179.849 | | 4.786 | | 54.256 | | 4.906 | | 282.781 | |
| 4.0-4.5 | 62.415 | | 4.630 | | 39.812 | | 4.857 | | 4.986 | |
| 4.5-5.0 | 4.922 | | 4.507 | | 26.256 | | 4.906 | | 4.927 | |

# APPENDIX C

## PROPOSED REMEDIAL TECHNOLOGIES FOR CONTAMINATED SOIL, WASTE PILES, BUILDINGS STRUCTURES AND EQUIPMENT

### Table 1: Proposed Remedial Technologies for Contaminated Soil - Long List

| General Response Action | Remedial Technology | Description |
|---|---|---|
| No Action | No Action | The no action alternative provides a baseline against which other alternatives can be compared. Although no remedial action will be carried out, environmental monitoring and institutional controls (IC), which restrict land use, are required in most cases. The simplest form of IC is in a regulatory notice or certification of No Further Action (NFA), where land use restrictions could be imposed by the regulating authority.<br><br>This alternative includes negotiations between landowner(s) and responsible authorities, establishment of the legal framework necessary to implement the IC, and limited corrective action and/or long-term monitoring of site contamination. |
| Site Controls | Access Controls<br><br>Environmental Controls<br><br>Traffic Controls | Site controls are used in conjunction with short- and/or long-term remediation, and may be a condition of an IC. Site controls may include access controls (e.g., fencing, warning signage, security monitoring, and alarm systems); traffic controls (e.g., regulated speed limits and no stopping zones); and environmental controls (e.g., water use). For this alternative public education and enforcement activities might be required. |
| Resource Recovery | Recycling | Soil contaminated with elevated lead concentrations could be processed for lead recovery using conventional base metal extraction processes. This involves segregation of high-grade contaminated soil followed by lead extraction by leaching, concentrating, smelting, or electro-winning. |

**Table 1: Proposed Remedial Technologies for Contaminated Soil Long List (cont.)**

| General Response Action | Remedial Technology | Description |
|---|---|---|
| Treatment | Solidification/ stabilization and off site disposal | Solidification involves the addition of chemical reagents to the contaminated soil and results in the formation of a solid monolithic mass. The contaminants do not necessarily interact chemically with the solidification reagents (e.g., cement/lime), but are physically encapsulated in a solidified matrix. This reduces the accessibility of contaminants to mobilizing agents such as groundwater or stormwater.<br><br>Stabilization technologies use chemical reagents which react with the soil contaminants and transform them into an immobile form. The produced mixture is resistant to leaching.<br><br>This alternative encompasses contaminated surface and subsurface soil excavation, followed by soil treatment with a pozzolanic stabilization process. If the treated soil is less than the Toxicity Characteristic Leaching Procedure (TCLP) for lead, it can be disposed on site or off-site in a sanitary landfill. |
| Treatment | Soil Washing | Soil washing exploits size, density, surface chemistry, and magnetic differences between contaminants, and contaminated and uncontaminated soil particles. Soil washing relies on favorable distribution of soil contaminants (e.g., according to particle size) which can be exploited by separation processes to produce a concentrated fraction.<br><br>The process starts by screening contaminated soil according to particle size. The larger particles can be washed either by water or solvent and recycled to the site. The smaller particles are washed by a wash solution to suspend or dissolve the contaminants into the solution or to concentrate the contaminants into the sludge remaining from this treatment process. While in the former case, the wastewater must be treated, in the later case the sludge must be disposed of appropriately in a landfill site.<br><br>This technique involves excavation of contaminated soil, followed by soil washing with a solution (nitric acid or EDTA), where treated soil is returned to the site for disposal in the excavated area. Produced wastewater requires post treatment. |

**Table 1: Proposed Remedial Technologies for Contaminated Soil - Long List (cont.)**

| General Response Action | Remedial Technology | Description |
|---|---|---|
| Containment | Capping/Covering | A cap is an engineered barrier of asphalt, concrete, heavy-duty plastic lining, 40 cm of compacted clay, etc., which is placed over landfills or repositories of consolidated waste to prevent water penetration. Caps usually require some level of long-term monitoring and may include IC or land use restrictions.<br><br>This technique involves contaminated soil consolidation into a cell or repository, followed by contouring or grading, and compaction to specifications. A cap is constructed over the completed repository and may consist of several layers depending on requirements. Earthen caps are commonly vegetated and drainage systems are usually included to control stormwater run-on and run-off. Sometimes institutional and/or site access controls as well as public education are required. |
| Removal | Excavation and off site disposal | Solid or semi solid materials can be removed by excavation. This technique could be cost-prohibitive for sites of large volumes, great depth, or complex hydrogeologic environments. The feasibility of this process requires knowledge of land disposal restrictions and other regulations developed by the government. Landfilling of hazardous material is expensive due to regulatory control. Excavation can be accomplished by a wide range of conventional equipment such as cranes, draglines, dozers, and loaders. The hauling equipment includes scrapers, haulers, dredges, bulldozers, and loaders. Fugitive dust from excavation is commonly controlled by chemical dust suppressants, wind screens, water spraying, and other dust control measures. |

## Table 2: Proposed Remedial Technologies for Waste Piles - Long List

| General Response Action | Remedial Technology | Description |
|---|---|---|
| No Action | No Action | Similar to the remediation of contaminated soil, the No Action alternative will be used as a baseline against which other alternatives can be compared. This alternative might include environmental monitoring to prevent contaminants from off site migration., institutional control, and/or limited corrective action. |
| Treatment | On Site Washing | This process is similar to but less complicated than acid leaching of soil. This process involves waste piles screening and washing with a leaching agent (e.g., nitric acid) to remove lead. The sludge washed from the plastic, ebonite battery casing, and debris is recovered as a by-product. The cleaned plastic casing chips can be sold to a plastic manufacturer for recycling. |
| Removal | Waste Piles Removal Off-Site Disposal | Waste pile removal and off-site disposal encompasses excavation, removal, transportation, and disposal in a landfill site. |
| Resource Recovery | Recycling | This process comprises excavation of waste piles, followed by on-site separation of fragments, and recycling of components that can be recycled. Recycling of components may be carried out on site or off-site. During recycling the mixed primary source materials are separated into components of lead fines, plastic, and ebonite. |

**Table 3: Proposed Remedial Technologies for Buildings Structures and Equipment - Long List**

| General Response Action | Remedial Technology | Description |
|---|---|---|
| No Action | No Action | This alternative might involve institutional control, environmental monitoring, and site use restrictions. |
| Building Demolition | Demolition and Off-site Disposal | This technique involves equipment dismantling into components or manageable pieces. This method separates types of equipment that are not feasible to be decontaminated and have to be disposed off as hazardous waste from that equipment which can be disposed off as non-hazardous waste. |
| Decontamination | Washing/Cleaning | Decontamination of structures and equipment includes waste removal, treatment of process equipment, containers, and any other equipment used to treat hazardous waste. The decontamination process will vary based on the materials being decontaminated. There is no regulatory requirement specifying decontamination methods.<br><br>Among others hydro-blasting, steam cleaning, solvent washings, blasting, and pressure flushing could be used for building structure decontamination. All cleaning residues (e.g., rinse water, sandblasting grit) are hazardous wastes and must be managed accordingly unless it can be demonstrated that these residues are non-hazardous |

# APPENDIX D

# IDENTIFICATION AND ASSESSMENT METHODOLGY

## 1.1 Identification and Assessment Methodology

The impact identification and assessment methodology (Figure 1.1) starts with identifying potential primary environmental impacts caused by the proposed remediation alternatives. This is carried out using a modified version of the Leopold matrix (Tables 1.1 through 1.4). Impact identification was based on the analysis of project specifications and baseline information collected in the field, literature review and internet search of similar projects, interviews with governmental and non-governmental stakeholders as well as information received from stakeholders during the Scoping Meeting (Life-Lead Scoping Report, 2005).

The interactive scoping matrix was used to pinpoint areas where project activities would interact with components of the receiving environment (potential impacts). These could be both positive or negative interactions. The layout of the matrix is arranged as follows:

- The “y” axis of the matrix consists of a list of remediation activities. It also contains in a parallel column a list of aspects associated with each activity or group of activities.

- The “x” axis consists of the resources and receptors encountered in the receiving environment including its physical, biological, and socio-economic components. Resources and/or receptors of the receiving environment include the following:

  - Air quality
  - Noise
  - Soil quality
  - Surface water quality
  - Groundwater quality
  - Terrestrial life
  - Aquatic life
  - Public health and safety
  - Employment and training
  - Work place health and safety
  - Traffic
  - Utilities
  - Livelihood

Using this matrix, interaction between project activities and environmental components were identified. The identified interactions are then subjected to further analysis to examine whether they produce direct effects on the environment (primary impacts) or they would trigger sequential events that would finally affect other environmental receptors (secondary and higher order impacts).

The identified impacts were then subjected to a process of impact evaluation. Impact evaluation was based on pre-established criteria including:

- Magnitude of the impact.

- Impact duration.
- Reversibility of the effect on receptor.
- Spatial extent.
- Sensitivity or importance of the receptor.

The impact evaluation also takes into consideration the mitigation measures included in the Front End Engineering and Design (FEED) to which the project is committed. This is in addition to measures of good international practice.

A comparative analysis between the short list of remediation alternatives with respect to the identified significant impacts is carried out. Based on this analysis, the alternative(s) with the least significant impacts on the environment and which are easy to mitigate and/or mange are selected.

Significant environmental impacts of the selected alternative were subjected to further analysis for consideration of alternative mitigation measures, while insignificant impacts were not considered further. Mitigation measures were either incorporated as an integral part of the design or through management measures.

A monitoring plan was then formulated to ensure that project performance meets the standards and that the mitigation measures effectively achieve the desired level of impact minimization.

## 1.2 Key Sensitivities

A key input in the process of impact assessment is the identification of the sensitivities and constraints specific to the receiving environment and its vicinity. Potential impacts are usually evaluated in respect to their effects on specific receptors. Therefore, knowledge and information on the environment within which the proposed project will be located are essential.

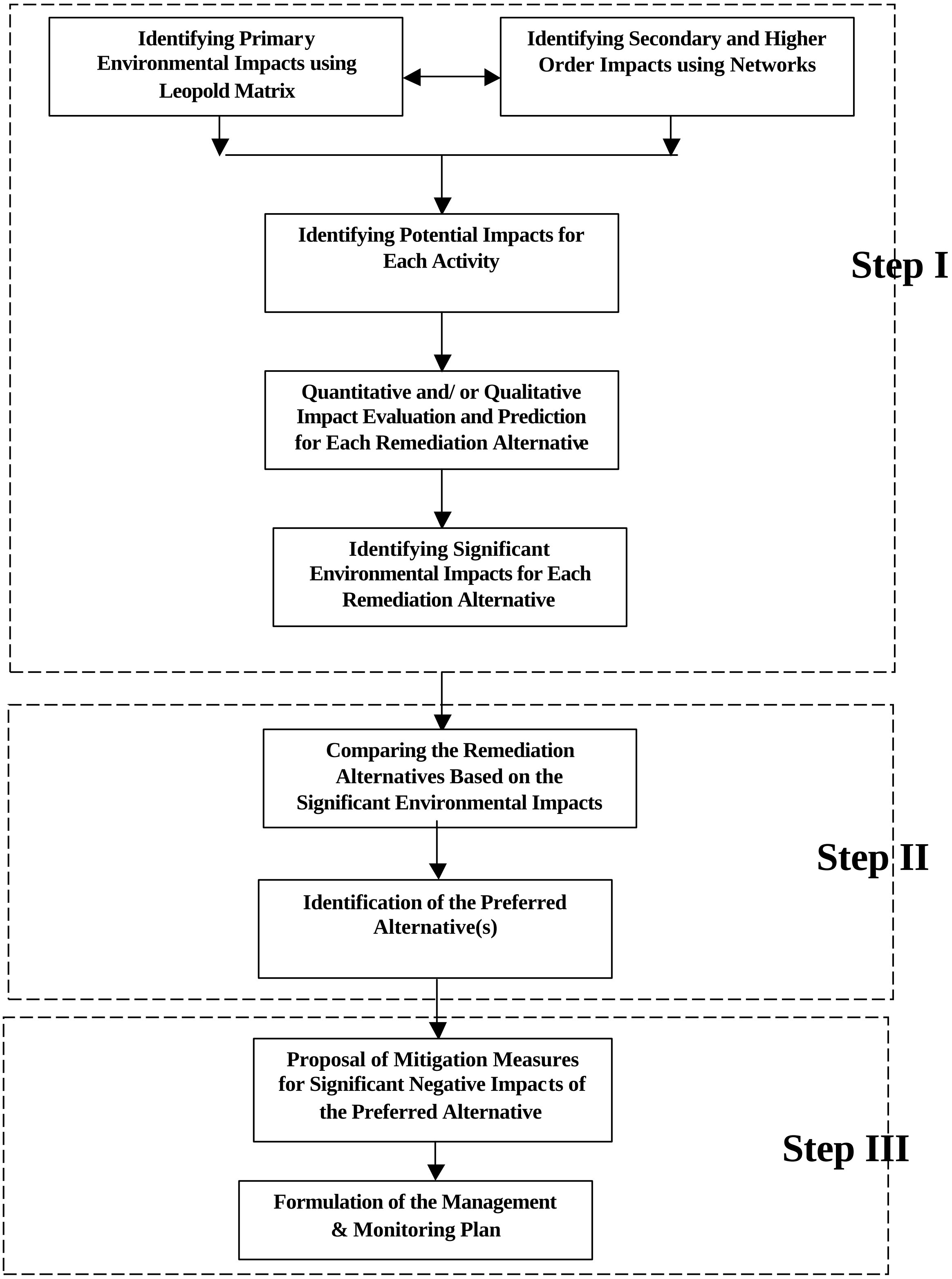
The EA team has gathered sufficient information on the project area and has analyzed their sensitivities as a crucial step in the assessment process. This information was gathered through literature reviews, interviews with officials and local residents, satellite image analysis, aerial photography analysis and field surveys.

The sensitivity or importance of the receptors depends on its nature, value, scarcity, zone of effect, etc. They can be categorized as follows:

- On site receptors such as soil, workplace health.
- Receptors surrounding the site such as ambient air, noise, public health.
- Final sinks/receptors such as surface and groundwater qualities. Impacts on these receptors are usually indirect (secondary/tertiary).

The network diagram (Figure 1.2) shows that dust emissions caused by the act of wind will primarily affect the ambient air quality. It could then deposit on the soil and surface water and potentially leach to the groundwater. Lead dust deposited on the soil could also affect public and/or worker health through direct contact. Human health could also be impacted through the inhalation of lead dust or the ingestion of contaminated groundwater or surface water.

**Figure 1.1: Impact Identification, Evaluation and Mitigation Framework**



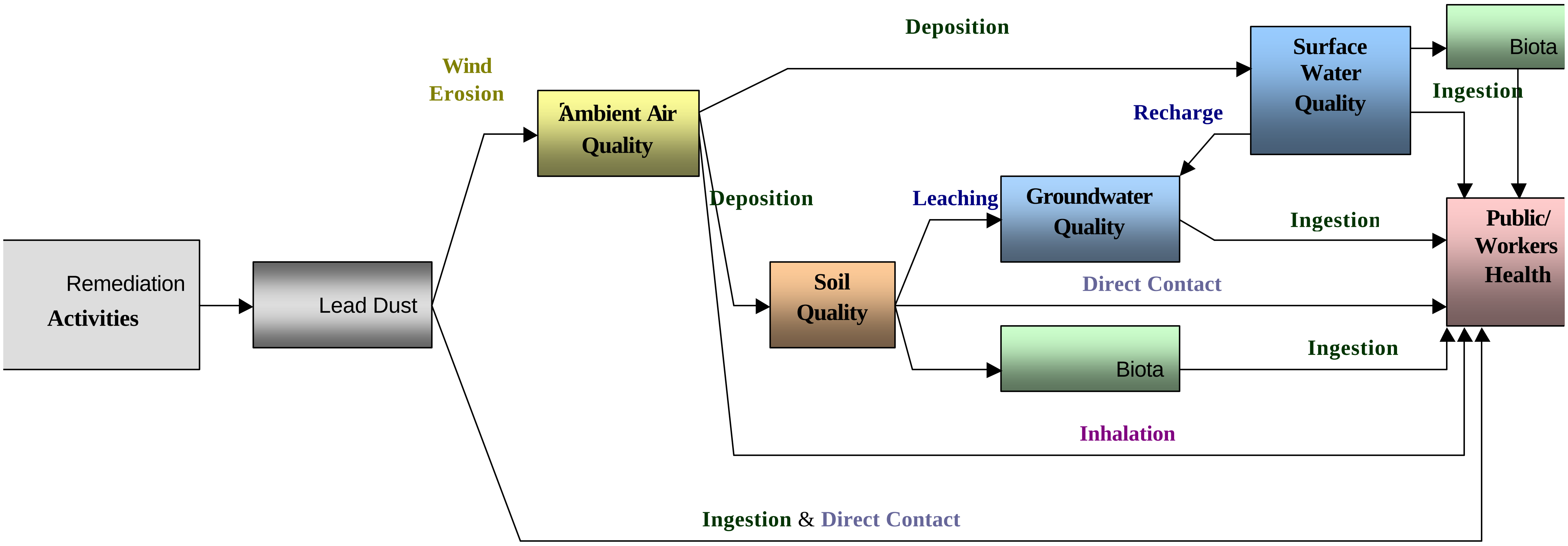



**Figure 1.2: Ecological Pathways Leading to First and Higher Order Environmental Impacts (primarily due to lead dust)**

## Table 1.1: Summary of Potential Environmental Impacts During Remediation (School)

| | | Environmental Attributes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Physical Environment | | | | | Biological Environment | | Socio-economic | | | | |
| Activities (Sources of Impacts) | Aspects | Air Quality | Noise | Soil Quality | Groundwater Quality | Surface Water Quality | Terrestrial Life | Aquatic life | Public Health & Safety | Employment | Work place Health & Safety | Traffic | Utilities |
| **Shoubra El Kheima** | | | | | | | | | | | | | |
| **Alternative 1: ?**<br>No action | • Pollution sources persist | - | NA | - | - | - | - | - | - | NA | NA | NA | NA |
| **Alternatives 2,3,4:**<br>Dry Vacuum Cleaning with HEPA vacuum | • Dust Emissions<br>• Emissions & Noise (vehicles & equipment)<br>• Polluted Filters | - | - | NA | NA | NA | NA | NA | NA | + | + | NA | NA |
| **Alternatives 2,3,4:**<br>Wet Cleaning and Surface Preparation<br>Window and Furniture Washing | • Contaminated Cleaning Mops<br>• Spills of detergents<br>• Waste packing and packaging | NA | NA | NA | NA | NA | NA | NA | NA | + | NA | NA | NA |
| **Alternatives 2,3,4:**<br>Removal and Replacement of Windows and Doors | • Waste window and doors<br>• Noise | NA | - | NA | NA | NA | NA | NA | NA | + | - | NA | NA |
| **Alternatives 2,3,4:**<br>Containment/Storage of Waste On Site | • Dust Emissions<br>• Spills of Wastewater and solid waste (hazardous & non-hazardous) | - | NA | - | - | NA | NA | NA | - | + | - | NA | - |
| **Alternatives 2,3,4:**<br>Transportation of Material, Labor and Equipment to School Site | • Dust Emissions<br>• Vehicles Emissions & Noise<br>• Traffic Accidents | - | - | NA | NA | - | - | - | - | + | - | - | NA |
| **Alternatives 2,3,4:**<br>Washing of equipment and showering in decontamination chamber | • Contaminated wastewater | NA | NA | - | - | NA | NA | NA | NA | + | + | NA | NA |
| **Alternatives 3,4:**<br>Interior and Exterior Wall Painting | • Waste paint & solvents<br>• Emission of volatile vapors | NA | NA | NA | NA | NA | NA | NA | NA | + | - | NA | NA |
| **Alternatives 3,4:**<br>Scrape Top Soil from places exceeding clean-up levels and Place Concrete tiles | • Dust Emissions<br>• Emissions & Noise (vehicles & equipment)<br>• Contaminated soil (limited amount) | - | - | +/- | NA | NA | NA | NA | - | + | - | NA | NA |
| **Alternatives 3:**<br>Covering playground with clean sand | • Dust Emissions<br>• Emissions & Noise (vehicles & equipment) | - | - | +/- | - | NA | NA | NA | NA | + | - | NA | NA |
| **Alternatives 4:**<br>Capping playground with plain concrete cap | • Emissions & Noise (vehicles & equipment)<br>• Waste concrete | - | - | +/- | NA | NA | NA | NA | NA | + | - | NA | NA |
| **Route from School to Nasereya Landfill in Alexandria** | | | | | | | | | | | | | |
| **Alternatives 2,3,4:**<br>Transportation of Contaminated Soil, Hazardous Waste to Nasereya | • Dust Emissions<br>• Vehicles Emissions & Noise<br>• Traffic Accidents<br>• Spillage of hazardous waste or contaminated soil | - | - | - | NA | - | - | - | - | + | - | - | NA |
| **Route from School to Abu Zabaal Landfill** | | | | | | | | | | | | | |
| **Alternatives 2,3,4:**<br>Transportation of Non-hazardous Waste to Abu Zabaal | • Dust Emissions<br>• Vehicles Emissions & Noise<br>• Traffic Accidents | - | - | - | NA | - | - | - | - | + | - | - | NA |

**-** Negative Impact  Positive Impact  NA Not Applicable

## Table 1.2: Summary of Potential Environmental Impacts During Remediation (Awadallah)

| Activities (Sources of Impacts) | Aspects | Environmental Attributes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Physical Environment | | | | | Biological Environment | | Socio-economic | | | | |
| | | Air Quality | Noise | Soil Quality | Groundwater Quality | Surface Water Quality | Terrestrial Life | Aquatic life | Public Health & Safety | Employment | Work place Health &Safety | Traffic | Utilities |
| **Shoubra El Kheima** | | | | | | | | | | | | | |
| **Alternative 1: ?** No action | • Pollution sources persist | - | NA | - | - | - | - | - | - | NA | NA | NA | NA |
| **Alternative 2,3,4:** Construction of Decontamination Pad & temporary Containment | • Dust Emissions<br>• Emissions & Noise (vehicles & equipment) | - | - | NA | NA | NA | NA | NA | - | + | - | NA | - |
| **Alternative 2,3,4:** Pressure Washing of Walls | • Wastewater<br>• Emissions & Noise (vehicles & equipment) | - | - | - | - | NA | NA | NA | NA | + | - | NA | - |
| **Alternatives 2,3,4:** Dry Vacuum Cleaning of Walls | • Dust Emissions<br>• Emissions & Noise (vehicles & equipment)<br>• Polluted Filters | - | - | - | NA | NA | NA | NA | NA | + | - | NA | NA |
| **Alternatives 2,3,4:** Containment/Storage of Waste on Site | • Dust Emissions<br>• Spills of Wastewater and solid waste (hazardous & non-hazardous) | - | NA | - | - | NA | NA | NA | - | + | - | NA | - |
| **Alternatives 2,3,4:** Transportation of Material, Labor and Equipment to Smelter Site | • Dust Emissions<br>• Vehicles Emissions & Noise<br>• Traffic Accidents | - | - | NA | NA | - | - | - | - | + | - | - | NA |
| **Alternatives 2,3,4:** Exterior Wall Painting | • Waste paint & solvents<br>• Emission of volatile vapors | NA | NA | NA | NA | NA | NA | NA | NA | + | - | NA | NA |
| **Alternatives 3,4:** Limited Soil Removal | • Dust Emissions<br>• Emissions & Noise (vehicles & equipment)<br>• Contaminated soil (temporary storage on site) | - | - | +/- | - | NA | NA | NA | - | + | - | NA | - |
| **Alternative 3:** Application of Protective Cover (gravel or CMB) | • Dust Emissions<br>• Emissions & Noise (vehicles & equipment)<br>• Waste capping material | - | - | +/- | NA | NA | NA | NA | - | + | - | NA | NA |
| **Alternative 4:** Application of Protective Cap (asphalt concrete with gravel or CMB bedding) | • Dust Emissions<br>• Emissions & Noise (vehicles & equipment)<br>• Waste Asphalt concrete and capping material | - | - | +/- | NA | NA | NA | NA | - | + | - | NA | NA |
| | | | | | | | | | | | | | |
| **Alternatives 2,3,4:** Transportation of Contaminated debris, soil, Hazardous Waste to Nasereya | • Dust Emissions<br>• Vehicles Emissions & Noise<br>• Traffic Accidents<br>• Spillage of hazardous waste or contaminated soil | - | - | - | NA | - | - | - | - | + | - | - | NA |
| **Route from School to Abu Zaabal Landfill** | | | | | | | | | | | | | |
| **Alternatives 2,3,4:** Transportation of Non-hazardous Waste to Abu Zabaal | • Dust Emissions<br>• Vehicles Emissions & Noise<br>• Traffic Accidents | - | - | - | NA | - | - | - | - | + | - | - | NA |

- Negative Impact    Positive Impact    NA Not Applicable

## Table 1.3: Summary of Potential Environmental Impacts During Remediation (Seoudi)

| | | Environmental Attributes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Physical Environment | | | | | Biological Environment | | Socio-economic | | | | |
| Activities (Sources of Impacts) | Aspects | Air Quality | Noise | Soil Quality | Groundwater Quality | Surface Water Quality | Terrestrial Life | Aquatic life | Public Health & Safety | Employment | Work place Health &Safety | Traffic | Utilities |
| **Shoubra El Kheima** | | | | | | | | | | | | | |
| **<u>Alternative 1:</u> ?** No action | • Pollution sources persist | - | NA | - | - | - | - | - | - | NA | NA | NA | NA |
| **<u>Alternative 2,3,4:</u>** Construction of Decontamination Pad & temporary Containment | • Dust Emissions<br>• Emissions & Noise (vehicles & equipment) | - | - | NA | NA | NA | NA | NA | - | + | - | NA | - |
| **<u>Alternative 2,3,4:</u>** Pressure Washing of Walls | • Wastewater<br>• Emissions & Noise (vehicles & equipment) | - | - | - | - | NA | NA | NA | NA | + | - | NA | - |
| **<u>Alternative 2,3, 4:</u>** Demolish Walls | • Dust Emissions<br>• Demolition waste<br>• Emissions & Noise (vehicles & equipment) | - | - | - | NA | NA | NA | NA | - | | - | NA | NA |
| **<u>Alternatives 2,3,4:</u>** Containment/Storage of Waste on Site | • Dust Emissions<br>• Spills of Wastewater and solid waste (hazardous & non-hazardous) | - | NA | - | - | NA | NA | NA | - | + | - | NA | - |
| **<u>Alternatives 2,3,4:</u>** Transportation of Material, Labor and Equipment to Smelter Site | • Dust Emissions<br>• Vehicles Emissions & Noise<br>• Traffic Accidents | - | - | NA | NA | - | - | - | - | + | - | - | NA |
| **<u>Alternatives 2,3,4:</u>** Exterior Wall Painting | • Waste paint & solvents<br>• Emission of volatile vapors | NA | NA | NA | NA | NA | NA | NA | NA | + | - | NA | NA |
| **<u>Alternatives 3,4:</u>** Soil Removal/ Excavation and backfill | • Dust Emissions<br>• Emissions & Noise (vehicles & equipment)<br>• Contaminated soil (temporary storage on site) | - | - | +/- | - | NA | NA | NA | - | + | - | NA | - |
| **<u>Alternative 3, 4:</u>** Application of Reinforced Concrete ? Cap | • Dust Emissions<br>• Emissions & Noise (vehicles & equipment)<br>• Waste concrete, packing material | - | - | +/- | NA | NA | NA | NA | - | + | - | NA | NA |
| **<u>Alternative 4:</u>** On-site soil treatment & backfill | • Dust Emissions<br>• Emissions & Noise (vehicles & equipment)<br>• Increase in soil volume (10-15%)<br>• Non hazardous soil | - | - | +/- | - | NA | NA | NA | - | + | - | NA | - |
| | | | | | | | | | | | | | |
| Transportation of Contaminated debris, soil, Hazardous Waste to Nasereya | • Dust Emissions<br>• Vehicles Emissions & Noise<br>• Traffic Accidents<br>• Spillage of hazardous waste or contaminated soil | - | - | - | NA | - | - | - | - | + | - | - | NA |
| **Route from School to Abu Zaabal Landfill** | | | | | | | | | | | | | |
| Transportation of Non-hazardous Waste to Abu Zabaal | • Dust Emissions<br>• Vehicles Emissions & Noise<br>• Traffic Accidents | - | - | - | NA | - | - | - | - | + | - | - | NA |

- Negative Impact Positive Impact NA Not Applicable

## Table 1.4: Summary of Potential Environmental Impacts During Remediation (El Mahy)

| | | Environmental Attributes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Physical Environment | | | | | Biological Environment | | Socio-economic | | | | |
| **Activities (Sources of Impacts)** | **Aspects** | **Air Quality** | **Noise** | **Soil Quality** | **Groundwater Quality** | **Surface Water Quality** | **Terrestrial Life** | **Aquatic life** | **Public Health & Safety** | **Employment** | **Work place Health &Safety** | **Traffic** | **Utilities** |
| **Shoubra El Kheima** | | | | | | | | | | | | | |
| **Alternative 1: ?**<br>No action | • Pollution sources persist | - | NA | - | - | - | - | - | - | NA | NA | NA | NA |
| **Alternative 2,3,4:**<br>Construction of Decontamination Pad & temporary Containment | • Dust Emissions<br>• Emissions & Noise (vehicles & equipment) | - | - | NA | NA | NA | NA | NA | - | + | - | NA | - |
| **Alternative 2,3,4:**<br>Pressure Washing of Walls & Equipment | • Wastewater<br>• Emissions & Noise (vehicles & equipment) | - | - | - | - | NA | NA | NA | NA | + | - | NA | - |
| **Alternatives 2,3,4:**<br>Dry Vacuum Cleaning of Walls and Equipment | • Dust Emissions<br>• Emissions & Noise (vehicles & equipment)<br>• Polluted Filters | - | - | - | NA | NA | NA | NA | NA | + | - | NA | NA |
| **Alternative 2,3,4:**<br>Sorting and Decontamination of Piles | • Wastewater<br>• Emissions & Noise (vehicles & equipment)<br>• Decontaminated Piles | - | - | - | - | NA | NA | NA | NA | + | - | NA | - |
| **Alternative 2,3, 4:**<br>Dismantling of Equipment | • Dust Emissions<br>• Emissions & Noise (vehicles & equipment) | - | - | - | NA | NA | NA | NA | - | | - | NA | NA |
| **Alternatives 2,3,4:**<br>Containment/Storage of Waste on Site | • Dust Emissions<br>• Spills of Wastewater and solid waste (hazardous & non-hazardous) | - | NA | - | - | NA | NA | NA | - | + | - | NA | - |
| **Alternatives 2,3,4:**<br>Transportation of Material, Labor and Equipment to Smelter Site | • Dust Emissions<br>• Vehicles Emissions & Noise<br>• Traffic Accidents | - | - | NA | NA | - | - | - | - | + | - | - | NA |
| **Alternatives 2,3,4:**<br>Exterior Wall Painting | • Waste paint & solvents<br>• Emission of volatile vapors | NA | NA | NA | NA | NA | NA | NA | NA | + | - | NA | NA |
| **Alternatives 3,4:**<br>Soil Removal/ Excavation and backfill | • Dust Emissions<br>• Emissions & Noise (vehicles & equipment)<br>• Contaminated soil (temporary storage on site) | - | - | +/- | - | NA | NA | NA | - | + | - | NA | - |
| **Alternative 3, 4:**<br>Application of Protective Concrete ? Cap | • Dust Emissions<br>• Emissions & Noise (vehicles & equipment)<br>• Waste concrete, packing material | - | - | +/- | NA | NA | NA | NA | - | + | - | NA | NA |
| **Alternative 4:**<br>On-site soil treatment & backfill | • Dust Emissions<br>• Emissions & Noise (vehicles & equipment)<br>• Increase in soil volume (10-15%)<br>• Non hazardous soil | - | - | +/- | - | NA | NA | NA | - | + | - | NA | - |
| | | | | | | | | | | | | | |
| Transportation of Contaminated debris, soil, Hazardous Waste to Nasereya | • Dust Emissions<br>• Vehicles Emissions & Noise<br>• Traffic Accidents<br>• Spillage of hazardous waste or contaminated soil | - | - | - | NA | - | - | - | - | + | - | - | NA |
| **Route from School to Abu Zaabal Landfill** | | | | | | | | | | | | | |
| Transportation of Non-hazardous Waste to Abu Zabaal | • Dust Emissions<br>• Vehicles Emissions & Noise<br>• Traffic Accidents | - | - | - | NA | - | - | - | - | + | - | - | NA |

# APPENDIX E
# SUMMARY OF SCOPING REPORT AND OTHER PUBLIC COMMENTS

LIFE-Lead was initiated on August 18, 2004. The expected completion date of the project is August 17, 2006. The project consists of two primary activities which are subsequently divided into tasks and subtasks that further define the work to be accomplished. Activity 1 includes the technical work required to complete site remediation activities. Activity 2 provides community awareness and communications support for the technical activities and is intended to raise the awareness of the community pertaining to environmental issues and concerns from industrial facilities.

Previous studies funded by the USAID have helped understand lead pollution in Shoubra El Kheima. Background data collection activities associated with LIFE-Lead Activity 1 started in October 2004 to provide data relative to the present status of lead contamination in the Study Area. Meetings and coordination with governmental agencies, NGO's, smelter owners, and others were held to facilitate the sampling and site characterization phase of the project and to collect primary data for the EA.

A Scoping Session was held in the Shoubra El Kheima City Council on February 2, 2005 in preparation for the EA. The session focused on environmental issues related to the remediation activities at the smelter sites and school. This section summarizes scoping activities to date.

## MEETINGS WITH GOVERNMENTAL AGENCIES

### Meetings with EEAA

#### Working Group on EA/EIA

An EA/EIA Working Group was formed to facilitate the preparation of the EA. The working group consisted of staff from LIFE-Lead as well as the EEAA and GOQ. The EEAA staff included members from the EIA, Hazardous Waste, Hazardous Substances, Regional Branch and Industrial Departments. The Working Group meet every other week to prepare and discuss EA/EIA project components.

#### Proposed Remediation Clean-up Goals

Remediation clean-up goals have not been established in Egypt. Several meetings were held with the EEAA's Environmental Quality Sector, Hazardous Waste Department, and Environmental Health Department to discuss clean-up levels and to agree upon a procedure to establish clean-up levels.

The consensus was reached that clean-up levels would be set on a site specific case based on the results of a Health Risk Assessment. In addition, the EEAA agreed to action levels that would trigger investigation of a potentially contaminated site.

### Meetings with Governorate Of Qalyoubia (GOQ)

Weekly meetings were convened with General Farouk Khater, Head of the Shoubra El Kheima East District. Although those regular weekly meetings were for the overall coordination of project activities; issues related to the EA/EIA tasks were also on the agenda at these meetings. General Farouk Khater has also facilitated site visits for the EA/EIA team to the smelter sites and the Abu Zaabal Landfill in Abu Zaabal.

**Education Directorate and the Agency for Educational Buildings**

### GOQ-Education Department

A meeting was held on Wednesday, December 1, 2004 in the office of the General Manager of the Education Department in Qalyoubia. The purpose of the meeting was to discuss the school activities to be implemented by the project including the sampling activities to be undertaken for the site characterization.

### GOQ-El-Shahid Ahmed Shallan School

A meeting was held with El Shahid Ahmed Shaalan school teachers and management on Wednesday, December 8, 2004 and included representatives from the Qalyoubia Education Department. The purpose of the meeting was to inform and coordinate with the school administration the upcoming site characterization activities.

## MEETINGS WITH THE SMELTER OWNERS

During the weekly meetings at Shoubra El Kheima East District, the smelter owners/ representatives were invited to attend and were present in most meetings. This was a significant factor in opening a forum with them on the different stages of the project. The process of the EA/EIA and the need for a defined future use for the sites were the primary issues discussed with the smelter owners and their representatives.

## MEETINGS WITH COMMUNITY REPRESENTATIVES AND NGO'S

Local NGO's attended the weekly meetings at the Shoubra El Kheima East District. A meeting was held with the Community Advisory Committee on Wednesday, January 26, 2005 to obtain their thoughts on the remediation process and to encourage them to attend the Scoping Meeting.

## TRIPARTITE LEGAL AGREEMENTS

Tripartite legal agreements were drafted by the project and signed by the school management, smelters owners, EEAA and the GOQ representatives to stipulate the mutual commitments of all parties. By signing these agreements the school management, smelters owners, guarantee accessibility to their facilities, declare the planned future use of their lands, and commit themselves to cooperate with all project's activities. In return, EEAA and GOQ would suspend all fines and accusations against these smelters until the conclusion of the remediation processes.

## SCOPING MEETING

The scoping meeting was held on February 2, 2005 in the Shoubra El Kheima City Council Main Hall. Presentations at the meeting were in Arabic with translation into English. Comments received were in Arabic. Comments and statements by the participants were recorded. A scoping comments statement was provided to allow participants an opportunity to comment in writing if they were reluctant to provide verbal comments.

The Governor of Qalyoubia, H.E. Adly Hussein addressed the meeting in the opening session. The Minister of State for Environmental Affairs Dr. Magued George nominated Dr. Fatma Abou Shouk, Head of the Environmental Management Sector in EEAA to represent the Ministry and address the attendees at the meeting. Opening remarks by Mr. Ron Daniel, USAID Environment Office and Mr. Kirk Ellis, Chief of Party, LIFE-Lead concluded the opening session.

Sixty-five invitations to stakeholders and individuals outside EEAA and the project team were circulated one week prior to the meeting. An announcement for the meeting was posted in the public announcements board at the Shoubra El Kheima East District five days before the meeting. Fifty-seven participants registered at the meeting. A breakdown of the attendees is provided in the following:

- Twelve from the GOQ or Central Government Departments.
- Twelve representatives from the parliament and the local popular councils.
- Five representatives of the Shoubra El Kheima East District.
- Three representatives from the Shoubra El Kheima West District.
- Six representatives from the Education Directorate Agency for Educational Buildings and School.
- Four representatives from active local NGO's in the East District.
- One representative from the Health Directorate.
- Five representatives from the smelter and foundry owners.
- Seven representatives from Universities, lawyers, and consultancies.
- Four representatives from the local media.

In addition, sixteen representatives of EEAA, four representatives from USAID, and 19 members of the LIFE-Lead project team participated in the meeting.

## Comments Received

The comments session was moderated by Dr. Zeinab Safar and Dr. Khaled Fahmy from the project team. Eleven participants outside the project team made statements. In addition, Dr. Khaled Fahmy, Dr. Fathiya Soliman, Dr. Ali Hassan, and Dr. Zeinab Safar from the project team and Eng. Ahmed Abou El-Seoud, EEAA, provided informational responses to comments or offered comments on behalf of EEAA and GOQ. A summary of the issues raised in these comments and to be addressed in the EA is presented below:

- Air Quality
- Noise
- Soil
- Surface and Groundwater Quality
- Public Health and Safety
- Workplace Health and Safety
- Traffic

## Written Statements Received

During the meeting, participants were encouraged to provide written comments. A period of one week ending on Tuesday, February 8, 2005 was announced as a deadline for submittal of written comments. Two participants and one member of the Education Department (who was not attending the session but attended the prior meetings held on scoping activities) submitted written responses to the scoping comments statement.

## Scoping Statement

The Scoping Statement for Life-Lead was submitted to the USAID Cairo Mission on March 22, 2005. The Scoping Statement was approved by USAID Washington in April 2005.

# APPENDIX F

# CONTACTS LIST

LIST OF AGENCIES, INSTIUTIONS AND NGOS CONSULTED BY THE ENVIRONMENTAL TEAM DURING SCOPING

## Governmental Agencies

- EEAA
    - Environmental Management Sector
    - Environmental Quality Sector
    - Greater Cairo regional Branch Office (RBO)
    - Industrial Unit
- Governorate Of Qalyoubia (GOQ)
    - Central Level (Governor Office, Governorate Departments, and Shoubra El Kheima City)
    - Local Level (East Shoubra El-Kheima District, Environmental Management Unit-EMU)
    - Sectoral Level (Education, Health, Public Awareness, Information and Decision Support Directorates)
- Organization of Industrialization, Ministry of Industry
- Abu Zabaal Landfill in Qalyoubia

## Smelter and Foundry Owners

- Awadallah
- El-Mahey
- Seoudi
- Hafez Sons Cast Iron Foundry

## Community Representatives and NGO's

- Heads and members of local councils
- Religious figures
- Shoubra El-Kheima Association
- National Council for Women

## Other Organizations

- Hazardous Waste Management Project in Alexandria Governorate
- Authority for Geological Surveying

# APPENDIX G

## REFERENCES

Agency for Toxic Substances and Disease Registry (ATSDR) (2000). Case Studies in Environmental Medicine. Lead Toxicity, Environmental Alert. US Department of Health and Human Services, Division of Health and Human Services, Division of Health Education and Promotion.

ATSDR (1999). Toxicological Profile for Lead. US Department of Health and Human Services. Public Health Service. Agency for Toxic Substances and Disease Registry. Atlanta, Georgia.

Cairo Air Improvement Project (CAIP) (2003). Groundwater Investigation of a Secondary Lead Smelter In Shoubra El-Kheima Area. IWACO Egypt.

Cairo Air Improvement Project (CAIP). Preliminary Assessment (2002): Awadallah Secondary Lead Smelter in Shoubra El Kheima. Chemonics International, Inc. USAID/ Egypt, Office of Environment. USAID Contract No. 263-C-00-97-00090-00.

Chemonics International & Associates (1994). Comparing Heath Risks in Cairo, Egypt.

Egyptian Environmental Affairs Agency (2004). Air Monitoring Data for Shobra El Kheima.

Egyptian Environmental Affairs Agency (2000): Air Quality in Egypt.

Egyptian Environmental Affairs Agency (1999). Freshwater molluscs of Egypt. Publications of the National Biodiversity Unit No. 10.

Egyptian Environmental Affairs Agency (1999). The study on water quality of the Nile River. Pp. 52.

Egyptian Environmental Affairs Agency (1997). Birds known to occur in Egypt. Publications of the National Biodiversity Unit No. 8.

Egyptian Environmental Affairs Agency (1997). Freshwater fishes of Egypt. Publications of the National Biodiversity Unit No. 9.

Egyptian Environmental Affairs Agency (1996): Guidelines for Egyptian Environmental Impact Assessment

Egyptian Environmental Affairs Agency (1995). Egypt country study on biological diversity. Publications of the National Biodiversity Unit No. 3.

Egyptian Environmental Affairs Agency (1993). Habitat diversity: Egypt. Publications of the National Biodiversity Unit No. 1.

Egyptian Environmental Policy Project (EEPP) (2004). Epidemiological Study: Estimate of Body Load of Lead in Residents Living Near a Lead Smelter in Egypt. Cairo, Egypt

Egyptian Environmental Policy Project (EEPP) (2003). Baseline Human Health Risk Assessment: Awadallah Secondary Lead Smelter. Cairo, Egypt.

Egyptian Environmental Policy Project (EEPP) (2003). Air Quality Program. Site Investigation Report: Awadallah Secondary Lead Smelter. Cairo, Egypt.

Egyptian Meteorological Authority (1975) Climatic Atlas of Egypt, Arab Republic of Egypt, Ministry of Transport and communications.

IWAKO Egypt (2003) Groundwater Investigation of a Secondary Lead Smelter in Shoubra El Kheima Area. Draft Final report.

LIFE-Lead (2005a) Baseline Human Health Risk Assessment. Millennium Science and Engineering, Inc. USAID/ Egypt, Office of Environment.

LIFE-Lead (2005b) Evaluation of Remedial Alternatives. Final Draft. Millennium Science and Engineering, Inc. USAID/ Egypt, Office of Environment.

USEPA (2003) U.S. Environmental Protection Agency, Superfund Lead- Contaminated Residential Sites Handbook. OSWER 9285.7-35.

Usher, M.B.(1995). A world of change: Land-use patterns and arthropod communities. In: Insects in a changing environment; Harrington & Stork, Edts. AP, pp. 535.

U.S. Environmental Protection Agency (1994). OSWER Directive #9200.4-27P: Revised Interim Soil Lead (Pb) Guidance for CERCLA Sites and RCRA Corrective Action Facilities. EPA/540/F-94/043 PB94-963282.

US-EPA (1997). The Benefits and Costs of the Clean Air Act, Final Report to Congress on Benefits and Costs of the Clean Air Act, 1970 to 1990. EPA-410-R-97-002. US Environmental Protection Agency

U.S. Environmental Protection Agency (1998a). OSWER Directive #9200.4-27P: Clarification to the 1994 Revised Interim Soil Lead (Pb) Guidance for CERCLA Sites and RCRA Corrective Action Facilities. EPA/540/F-94/030 PB98-963244

U.S. Environmental Protection Agency (1998b). OSWER Directive #9285.7-34. IEUBK Model Mass Fraction of Soil in Indoor Dust (MSD) Variable. EPA #540-F-00-008.

U.S. Environmental Protection Agency (2003). Handbook for Non-cancer Health Effects Valuation. Non-Cancer Health Effects Valuation Subcommittee of the EPA Social Science Discussion Group. EPA Science Policy Council. US Environmental Protection Agency. Washington DC.

U.S. Environmental Protection Agency (2003). OSWER Directive #9285.7-76. Assessing Intermittent or Variable Exposures at Lead Sites. EPA-540-R-03-008

U.S. Environmental Protection Agency (2004). Adult Lead Methodology Frequently Asked Questions.

The World Bank (1996). The World Bank Policies and Guidelines.

World Health Organization (2000). Guidelines for Air Quality. Geneva, World Health Organization

World Health Organization (2003). Assessing the Environmental Burden of Disease at National and Local Levels. Environmental Burden of Disease. Series 2- Lead. WHO, Geneva.

# APPENDIX H

## LIST OF ASSESSMENT PREPARERS

| NAME | DEGREE | POSITION |
|---|---|---|
| Kirk Ellis | M.S Civil Engineering | Life-Lead COP |
| Fathiya Soliman | PhD. Mechanical Engineering | Technical Design Manager |
| Ali Nasser | Prof. Biological Sciences | Lead EIA Expert |
| Dalia Nakhla | MSc. Environmental Engineering | EIA Expert |
| Maged Hamed | P.E. Environmental and Sanitary Engineering | Risk Assessment |
| Heba Wafa | Dr. Public Health | Health Risk Assessment Specialist |
| Lane Krahl | MSc. Environmental Policy | EA Specialist |
| Magued Youssef | MSc. Environmental Science & Policy | Technical Planning Coordinator |